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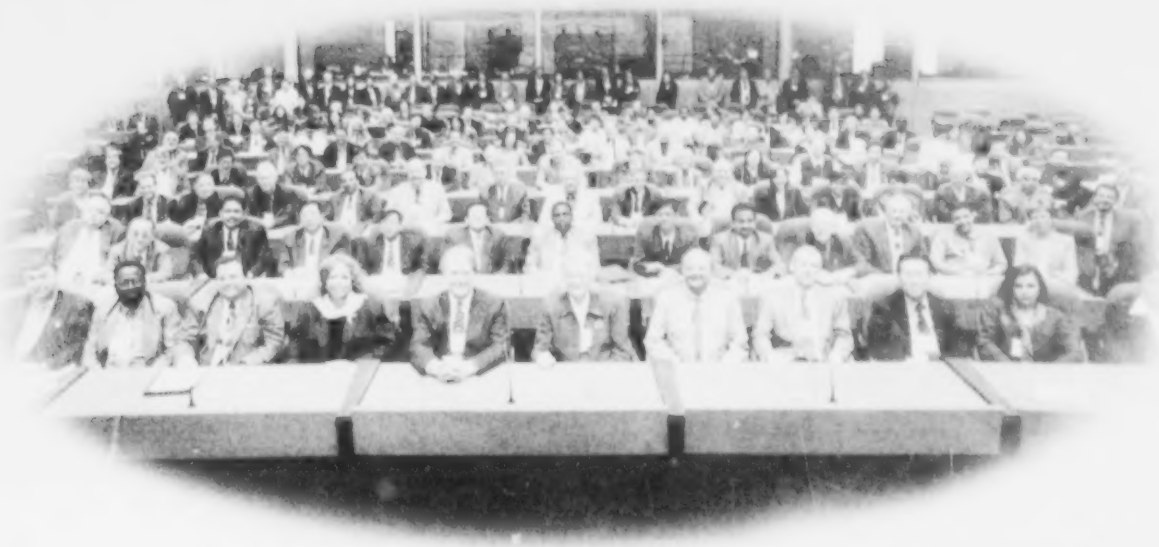
Cleaner Production

Sixth International High-level Seminar
Montreal



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editorials

Klaus Toepfer

United Nations Under Secretary-General and Executive Director, UNEP

"The global framework for changing current production and consumption patterns has been set – the time for ACTION is now!"

This is our primary challenge: to move from words to action. The Malmö Ministerial Declaration, adopted in May 2000 by Environment Ministers from around the world, recognized that the root causes of global environmental degradation lie in current unsustainable production and consumption patterns. The challenge before us is to reorient these unsustainable patterns by promoting a life cycle economy that incorporates a "Cleaner Production" strategy.

A Cleaner Production strategy implies:

- improving production processes – to increase resource use efficiency and replace non-renewable resources (both energy and materials) with renewable ones;
- designing new products which consume less material and energy, not only during production but throughout their whole life cycle;
- developing management tools to enable Cleaner Production practices in the day to day decision-making process;
- promoting and developing institutions which could help stakeholders implement Cleaner Production on a wider scale than ever before;
- influencing market forces to shift the focus from a product-based economy to one that is service-based.

It has been estimated that if the lifestyles of all the people in the world were comparable to those in developed countries today, we would need six more Planet Earths – just to dispose of the waste. We have to work towards improving the quality of life for the billions of people in developing countries, without further stressing the Earth's carrying capacity.

Greater integration of the Cleaner Production strategy with sustainable consumption practices is necessary to reconcile economic development with environmental protection. We have to develop initiatives to influence consumer choices, and to motivate them towards more rational and sustainable consumption patterns. UNEP's Advertising Initiative and Life Cycle Initiative are two steps in this direction.

The last few years have seen the development of important Multilateral Environmental Agreements to tackle global environmental issues (for example, the Basel Convention's Protocol on Liability, the International Treaty on Persistent Organic Pollutants, and the Convention on Biodiversity's Biosafety Protocol). Cleaner Production is a cost-efficient way to help facilitate implementation of these agreements. Approaches and measures need to be identified, so that the preventive strategies embodied in Cleaner Production can be used more effectively to address and resolve these global issues.

In October 2000, on the occasion of UNEP's Sixth High-level International Seminar on Cleaner Production in Montreal, Canada, I challenged everyone there by asking: "Who is interested in making change?" The 250 senior decision-makers present spent the next two days discussing who needs to do what, and what they would do when they returned to their countries and organizations. This special issue of *Industry and Environment* is devoted to summarizing the results of their hard work, and the commitments made to address the challenges before us. ●

David Anderson

Minister of the Environment for Canada, and President of the Governing Council of UNEP

Last October, Canada hosted the Sixth International High-level Seminar on Cleaner Production (CP6) in Montreal. Together with the first International Pollution Prevention Summit that immediately followed it, CP6 provided an unprecedented opportunity for over 250 representatives from government, business, community and non-governmental organizations to discuss pollution prevention and Cleaner Production. This was the largest-ever international pollution prevention event in terms of participants, diversity and scope.

Companies around the world are embracing pollution prevention and Cleaner Production – it's simply smart business. Rethinking production processes and reducing energy use protects our health and our environment. It is a pattern that is emerging in many countries, with enthusiastic supporters among small and medium-sized companies, as well as international corporate leaders such as Royal Dutch Shell, BP Amoco and Interface Inc.

Pollution prevention and Cleaner Production are growing strategies among Canadian manufacturers and are essential in the Government of Canada's approach to environmental protection. They bring together governments, businesses, NGOs, communities and individuals to make the right decisions, taking into account the healthy, natural environment that we need while stimulating economic growth. As President of the Governing Council of UNEP, I will be a strong advocate for this inclusive approach on the international stage.

Canada's commitment to pollution prevention is embodied in the new Canadian Environmental Protection Act (CEPA). This Act, which came into force in April 2000, is one of the most advanced environmental laws of its kind in the world. Making pollution ...

editorials

[illegible] prevention the priority approach to environmental protection is a significant step along the path to a sustainable environment.

Longer-term success in protecting and conserving the global environment will depend on the willingness of all members of the international community to seek creative solutions and foster innovation. Our global standard of living and quality of life depend on our ability to learn and adapt quickly to new discoveries, new ideas and new opportunities. Citizens must be fully engaged and understand the power they have to make a difference in the environment we share.

The challenge is to maintain the momentum developed at meetings and seminars such as CP6 and the International Pollution Prevention Summit in Montreal. While we have made some progress, continuing to promote the benefits of Cleaner Production will ensure that more businesses and consumers adopt sustainable environmental practices.

I will continue to advance the environmental protection agenda, and look forward to working with many of you at the World Summit on Sustainable Development. ◆

Milos Kuzvart

Minister of the Environment, Czech Republic

We were very pleased that we could participate in the Sixth International High-level Seminar on Cleaner Production. CP6 reviewed the state of the art and future prospects for implementating Cleaner Production. Recently, Cleaner Production become part of the strategic portfolio of the Czech government.

CP6 confirmed that there are many significant new achievements in CP worldwide. However, we also participated in discussions where it was pointed out that the desired broader adoption of CP by all stakeholders is not materializing as we would wish, and also as we might have assumed it would, given its clearly demonstrated benefits.

This represents a significant challenge (to the public and private sectors) to strengthen efforts and cooperation in this field, keeping in mind that people lose in both the environmental and economic areas if decisions are made without CP considerations.

UNEP's response to the challenge of going beyond demonstration and facilitating broad adoption of CP by all stakeholders was already presented in 1998, in the form of the International Declaration on Cleaner Production. The Czech Government adopted the CP Declaration on the occasion of the meeting of the UNIDO-UNEP National Cleaner Production Centres in Prague in 1999.

CP6 provided new insights into different concepts and tools utilized in this field, ranging from technological innovations in processes to the behaviour of consumers, and from reviewing progress in implementing the CP Declaration to linkages between CP and sustainable development.

Some topics kept recurring during many of the workshops and talks at CP6. They could be summarized by the question: "How to mainstream CP?" The call to create better framework conditions for promoting CP, and for integrating CP into important decisions within the private and public sectors, was heard very clearly. We have contributed to this discussion by our experience in launching the National Cleaner Production Programme adopted by the Czech government in February 2000.

The growing commitment of the Czech Republic to use CP as one of the strategies for implementing its core policies also leads to our growing engagement in this field on the international level. We feel very privileged that the Czech Republic can host the Seventh International High-level Seminar (CP7) in Prague in the spring of 2002. We would like to present some thoughts on its possible topics here.

The importance of CP7 will be underlined by the fact that its conclusions can contribute to the Rio+10 summit in South Africa in September 2002. CP7 could contribute to an evaluation of progress with respect to CP initiatives worldwide.

Lack of capacity to track and evaluate the effects of CP programmes, and to disseminate this information, still seems to be one of key challenges for CP initiatives.

CP is more a journey than a destination, and there is the question of how to obtain a broad commitment to a journey if the destination is perceived to be somehow vague.

What is the CP vision? Is it changing over time? The discussion on CP and sustainability, and/or broadening the horizon of CP at CP6, showed that clear linkage of CP strategy to particular principles of sustainable development could – together with a better description of its effects regarding the interests of particular stakeholders – increase commitment to CP.

The role of different stakeholders in promoting CP is another issue which is always relevant. We can observe that CP programmes involving different stakeholders on the local level are one of the most successful in putting CP initiatives on a self-sustainable basis.

What lessons can be derived for implementing Agenda 21 and vice versa? What can we learn from this experience with respect to policies promoting CP?

Many more questions come to mind in thinking about CP globally.

We look forward to CP7 in Prague contributing to the redirection of contemporary developments that lead to sustainability, through facilitating the mainstreaming of CP on the individual, corporate, local, regional and global levels. ◆

Introduction

Jacqueline Aloisi de Larderel
UNEP Assistant Executive Director
Director, Division of Technology, Industry and Economics

More than 12 years ago, UNEP declared Cleaner Production to be a vital part of strategies to achieve sustainable development. Since then, UNEP and its longtime partners in this work have promoted the CP concept worldwide.

Progress has occurred in many areas. For example:

- Decision-makers at all levels increasingly realize that it is to everyone's advantage to *prevent* pollution in processes, products and services – in an integrated way – instead of trying to control it after the fact.
- New tools – such as CP assessment, life cycle analysis, sustainable design, and, in a broader sense, environmental management systems, have been developed to meet the Cleaner Production challenge by improving efficiency, reducing environmental risk and conserving natural resources.
- Few if any institutions dealt specifically with Cleaner Production 12 years ago. Today, there are 19 UNIDO/UNEP National CP Centres. There are also hundreds of bodies such as the World Cleaner Production Society, the Philippines Cleaner Production Technology Center, the Argentine Cleaner Production Center, and the Centre for Sustainable Design in the U.K., to name just a few.
- To date, there are over 200 senior-level signatories to the International Declaration on Cleaner Production, including governments, companies and industry associations.
- Cleaner and safer production technologies have been (and continue to be) developed.
- Innovative CP financing projects and programmes are receiving increasing attention.

Jacqueline Aloisi de Larderel

Nevertheless, the progress made so far is far from complacency.

Economic activity is essential to eight billion people. However, it continues to increase the pressure on resources and ecosystems on the planet's carrying capacity.

The degree of 'decoupling' – the link between economic and environmental impacts, instead of assuming rising economic growth, stability and ecological decline – that economic growth continues to rise. And the commitment towards decoupling is limited to our few countries.

We cannot rely on gradual technological improvements to achieve Cleaner Production. We need quantum leaps which only innovative technologies can make possible.

Awareness is important, but it is not the same as taking action. Governments can and must play a leading role in establishing enabling legislative and economic frameworks for Cleaner Production and Sustainable Consumption. Companies should widely apply existing management tools; they should also integrate the environmental dimension into overall decision-making.

Consumers, whether they are companies or individuals, need to understand that Cleaner Production and Sustainable Consumption are two sides of the same coin.

UNEP's Sixth High-level International Seminar on Cleaner Production was about looking at progress, identifying barriers and opportunities, and establishing an agenda for further action. This issue of *Industry and Environment* highlights the main discussions and the recommendations adopted at Montreal. ◆

Thank you

UNEP expresses its appreciation to the Government of Canada for hosting the Sixth International High-level Seminar on Cleaner Production. In particular, it thanks David Anderson, Minister of the Environment, James Riordan, Acting Director General of the Toxics Pollution Prevention Directorate, Environment Canada, and Clifford Lincoln, Member of Parliament, Lac Saint-Louis, for the welcome they gave participants and for their insightful remarks.

Special thanks are given to Milos Kuzvart, Minister of the Environment of the Czech Republic, for sharing his country's experience with the International Declaration on Cleaner Production and his valuable participation throughout the Seminar. The other keynote speakers – Amory Lovins, Co-Executive Director of the Rocky Mountain Institute, Braden Allenby, Vice-President Environment at AT&T, and Kalyan P. Nyati, Head of the Environmental Management Division, Confederation of Indian Industry – presented stimulating ideas and provoked discussions. We are extremely grateful to all of them.

We are deeply indebted to the staff of Environment Canada and the Canadian Centre for Pollution Prevention for their assistance in planning and organizing the Seminar.

Finally, thanks are due to the governmental, business, NGO, academic and international agency representatives who demonstrated their commitment to sustainable production and consumption patterns by attending the Seminar and contributing invaluable input as chairs, rapporteurs or participants.

Presentation

This special issue of *Industry and Environment* covers the Sixth International High-level Seminar on Cleaner Production (CP6), organized by UNEP in cooperation with the Canadian Centre for Pollution Prevention. Hosted by the Government of Canada, the Seminar took place in Montreal on 15-17 October 2000. The International Pollution Prevention Summit, also hosted by the Government of Canada, was held immediately following, on 18-20 October.

Over 250 senior-level decision makers from some 85 countries – representing government, industry, academic institutions and non-governmental organizations – examined the status of sustainable production and consumption patterns. They outlined the work remaining to be done and identified concrete next steps.

Since 1989, UNEP has convened senior-level seminars to assess Cleaner Production achievements, identify remaining gaps, and establish a global framework for action to encourage synergies among various stakeholders. The Fifth High-level Seminar took place in Seoul in September 1998. The Czech Republic has offered to host the next Seminar in 2002.

Discussions at CP6 reflected the changes that have taken place since the Cleaner Production concept was introduced in 1989. Participants presented a vision of an emerging world of processes, products and services, and of current unsustainable production and consumption patterns. Consideration was given to ways in which new patterns could be developed.

One of the highlights of the Seminar was the success of the International Declaration on Cleaner Production, which was launched at the time of the Fifth High-level Seminar in 1998. At the opening reception, and throughout the two days of discussions at Montreal, signatures continued to be added. The total number of high-level signatories by the end of the Seminar was 223.

This Seminar served as a forum for discussion of critical issues concerning unsustainable production and consumption patterns, and (more specifically) Cleaner Production. These issues included: technological innovation; government policies and strategies; National Cleaner Production Centres; financing of Cleaner Production; twinning of industrial ecology and Cleaner Production; using Cleaner Production to facilitate multilateral environmental agreements; the importance of information exchange and sharing; and visions for the future.

The need to address the current impacts of consumption was also a major topic. Links between Cleaner Production and sustainable consumption were addressed in depth. Also central is the relationship between sustainable consumption and the need to change perceptions of desirable lifestyles among young people, so as to influence their consumption patterns. ◆

Présentation

Cette édition spéciale de la revue *Industry and Environment* est consacrée au Sixième séminaire international sur la Production plus propre (CP6), organisé par le PNUE en coopération avec le Centre canadien pour la prévention de la pollution. Le séminaire s'est déroulé à Montréal du 15 au 17 octobre 2000, sous l'égide du gouvernement canadien. Il a été suivi, du 18 au 20 octobre, du Sommet international pour la prévention de la pollution, également accueilli par le gouvernement canadien.

Plus de 250 décideurs de haut niveau de quelque 85 pays – représentant des gouvernements, des secteur industriels, des établissements universitaires et des ONG – ont fait le point sur les modes de production et de consommation compatibles avec un développement durable. Ils ont insisté sur le travail qui reste à faire et défini les prochaines mesures concrètes à prendre.

Depuis 1989, le PNUE réunit en séminaire des responsables de haut niveau qui dressent le bilan des progrès de la Production plus propre, identifient les lacunes qui restent à combler et définissent un cadre mondial d'action pour encourager les synergies entre diverses parties prenantes. Le Cinquième séminaire avait eu lieu en septembre 1998 à Séoul. La République tchèque a proposé d'accueillir le prochain séminaire, prévu en 2002.

Les débats de CP6 ont reflété les changements intervenus depuis le lancement du concept de Production plus propre, en 1989. Les participants ont donné la vision d'un monde émergeant de procédés, produits et services qui contraste avec les modes actuels de production et de consommation incompatibles avec un développement durable. Ils se sont interrogés sur les moyens d'instituer de nouveaux schémas de comportement dans ce domaine.

L'un des points mis en avant par le séminaire est le succès remporté par la Déclaration internationale pour la production plus propre depuis son lancement en 1998 à l'occasion du Cinquième séminaire. De nouvelles signatures ont d'ailleurs été recueillies lors de la réception d'ouverture et tout au long des deux journées de débats. A la fin du séminaire, le nombre total de signataires de haut niveau atteignait 223.

Cette réunion a servi de forum de discussion pour aborder des questions critiques, comme les modes de production et de consommation incompatibles avec un développement durable, et plus spécifiquement la Production plus propre, notamment : l'innovation technologique ; les stratégies et l'action des pouvoirs publics ; les Centres nationaux de production plus propre ; le financement de la Production plus propre ; le rapprochement entre l'écologie industrielle et la Production plus propre ; l'utilisation de la Production plus propre pour faciliter les accords multilatéraux sur l'environnement ; l'importance du partage et des échanges d'informations ; et les visions pour l'avenir.

La nécessité de considérer les impacts actuels de la consommation a également été au cœur des débats. Les liens entre la Production plus propre et les modes de consommation compatibles avec un développement durable ont été examinés en détail. Une autre question centrale a été abordée, celle du rapport entre les modes de consommation compatibles avec un développement durable et la nécessité de modifier chez les jeunes la perception des styles de vie désirables, afin de changer leurs modes de consommation. ◆

Presentación

Esta edición especial de *Industria y Medio Ambiente* abarca el Sexto Seminario Internacional de Alto Nivel sobre una Producción más Limpia (CP6), organizado por la UNEP en colaboración con el Centro Canadiense para la Prevención de la Contaminación. Patrocinado por el Gobierno de Canadá, el Seminario se desarrolló en Montreal entre el 15 y el 17 de octubre de 2000. La Cumbre Internacional sobre Prevención de Contaminación, patrocinada también por el Gobierno de Canadá, fue realizada inmediatamente después, del 18 al 20 de octubre de 2000.

Más de 250 ejecutivos formadores de opinión, provenientes de 85 países, de sectores representativos del gobierno, la industria, instituciones académicas y organizaciones no gubernamentales, estudiaron la situación de los patrones de producción y de consumo sustentables. Delinearon el trabajo pendiente e identificaron los pasos concretos a seguir.

Desde 1989, la UNEP viene convocando a seminarios de nivel ejecutivo para asesorar sobre los logros de una Producción más Limpia, identificando brechas pendientes y estableciendo un marco global de acción con el propósito de fomentar sinergias entre los distintos participantes. El Quinto Seminario de Alto Nivel se llevó a cabo en Seúl en septiembre de 1998. La República Checa ha ofrecido ser sede del próximo Seminario que se realizará en 2002.

Los debates de la CP6 reflejan los cambios que han ocurrido desde la introducción del concepto de Producción más Limpia en 1989. Los participantes presentaron una visión de un mundo emergente de procesos, productos y servicios y de una producción y un consumo no sustentables en la actualidad. Se consideraron formas de desarrollar nuevos patrones.

Uno de los momentos culminantes del Seminario fue el lanzamiento de la Declaración Internacional sobre una Producción más Limpia, dado que fue lanzada en oportunidad de realizarse el Quinto Seminario Internacional de Alto Nivel en 1998. En la ceremonia de apertura y durante los dos días de deliberaciones, se siguieron agregando firmantes. La cantidad total de signatarios de esta declaración al cabo del Seminario fue de 223.

Este Seminario sirvió como foro para discutir temas relacionados sobre patrones de producción y consumo sustentables y, más específicamente, Producción más Limpia. Los temas incluyeron innovación tecnológica, políticas y estrategias gubernamentales, Centros Nacionales de Producción más Limpia, herramientas de gestión ambiental y Producción más Limpia, uso de una Producción más Limpia para facilitar acuerdos ambientales multilaterales y compromisos de intercambiar y compartir información y tecnología para el futuro.

También se subrayó la necesidad de educar los mercados y el público del consumo. Se estudiaron en detalle las relaciones entre Producción más Limpia y consumo sustentable. Fue fundamental el análisis de la relación entre consumo sustentable y la necesidad de cambiar la percepción de la juventud sobre gestión de vida sustentable, a fin de cambiar sus patrones de consumo. ◆

Sixth International High-level Seminar on Cleaner Production 16-17 October 2000, Montreal, Canada

Recommendations

The following recommendations were adopted at Montreal. They were drawn from the general conclusions, which were presented at the end of each session and were based on plenary discussions.

1. Propel the International Declaration on Cleaner Production beyond the initial signing.

2. Integrate Cleaner Production and technology innovation.

3. Promote sustainable consumption patterns.

4. Incorporate Cleaner Production into government policies and strategies.

5. UNEP should continue to play its leadership role in developing and guiding National Cleaner Production Centres (NCPCs), both those handled in conjunction with UNIDO and those supported by other partners.

6. Promote Cleaner Production financing.

7. Facilitate synergies between Cleaner Production and Multilateral Environmental Agreements.

8. Use existing information collection and dissemination tools (e.g. Internet) rather than creating new ones.

9. Involve non technical stakeholders in Cleaner Production centre work.

10. Focus on the service sector.

11. Convene a small group of experts to analyze emerging trends and develop a vision for the future of sustainable production and consumption, culminating in an action plan.

Primarily as input to the World Summit on Sustainable Development, this work could also feed into preparation of a **global status report on Cleaner Production**, which would in turn be a CP™ contribution.

Keynote Speeches

Summary

Amory Lovins

Braden R. Allenby

Kalyan P. Nyati

Amory Lovins, Co-Executive Director of the Rocky Mountain Institute, an NGO based in the United States

During his keynote address at CP6's opening ceremony, Mr. Lovins described the concept of "natural capitalism" – doing business as if nature and people were properly valued. He presented this concept from a historical perspective, and provided observations from current industrial applications that underline its potential as a driver for change.

He noted that in the 18th century natural resources were abundant, but there was no way to utilize them efficiently. The Industrial Revolution, which began about the middle of that century, increased labour productivity a hundredfold. Today there is an abundance of people and scarcity of nature. Natural capitalism can be seen as a way to protect the biosphere, and to improve profit and competitiveness. The four principles of natural capitalism are:

- radically increase the productivity of natural resources – resource rather than waste;
- shift to biologically inspired production models – to designs creating closed loop systems that eliminate the concept of waste;
- move to a solutions-based business model in which value is delivered as a flow of services, rather than sale of goods. Acquisition of goods as a measure of affluence is replaced by measures of well-being based on continuous satisfaction of changing expectations for quality, utility and performance;
- reinvest in natural capital – restore, sustain and expand the planet's ecosystems so that they can produce their vital services and biological resources even more abundantly.

Mr. Lovins highlighted some surprising outcomes from business experience in applying one or more of these principles:

- The law of diminishing returns often does not apply. In fact, returns can be even greater with increased efficiencies. There are indications that there may be a law of expanding returns when natural capitalism is practised.
- Higher labour productivity is a side benefit of natural capitalism.

(For more information, consult *www.rmi.org* or *www.natcap.org*.)

Braden R. Allenby, Vice President Environment at AT&T in the United States

Mr. Allenby provided an industry perspective during the first plenary session. Cleaner Production can provide the desired quality of life with an acceptable social and environmental "footprint". Mr. Allenby focused on the need to change ways of thinking about economics and the environment. Current thinking about problems is outdated and essentially irrelevant. Human-driven artificial boundaries around how we think about impacts. For example, the environmental impacts of a "C" are rarely the concern of someone in a green-oriented company. How does one include environmental criteria in the activities of people in the economic world.

Deciding how to address problems, such as the impacts of an industry, may not be simple – and is not a problem that "engineering" can solve applied to service activities. The boundaries on the impacts of the industry and the appropriate reaction to general ecosystem changes will have to be addressed in the process. Governance by means of multiple stakeholders.

Mr. Allenby emphasized that the challenge of Cleaner Production is profoundly cultural. Whose idea of "good" do we use? How does industrialized society "do things"? How are we going to make the world sustainable? These are also cultural issues, not technical ones. Developing countries have a chance to leapfrog the problems of industrialized countries, and can apply Cleaner Production to minimize their "footprint", but many managers are not focused on it because they cannot connect this concept to getting their appropriate bonuses. ◆

Kalyan P. Nyati, Head of the Environmental Management Division, Confederation of Indian Industry

Mr. Nyati described the Confederation's role in Cleaner Production, particularly in the training area. Training, however, is only one of the important roles and functions of the Confederation. He emphasized that only business itself can make the necessary changes in its operations. Cleaner Production is being promoted at the lower administrative levels. Mr. Nyati offered a number of suggestions for furthering Cleaner Production implementation around the world:

- Cleaner Production can make a great difference in larger companies and multinationals, but it must also be implemented by small and medium-sized enterprises.
- Through networking and partnerships, national industry associations can be powerful Cleaner Production flag bearers in their own countries.
- Some members of the banking community are to be complimented for financing Cleaner Production initiatives, but more remains to be done. It is in the interest of the banking community to tell clients they should integrate Cleaner Production into production methods.
- Finally, to create implementation, Cleaner Production needs to be institutionalized by supporting it with ISO 14000 and other environmental management systems. ◆

The International Declaration on Cleaner Production: from signature to action

The Malmö Declaration, as well as the Millenium Summit Declaration, highlighted the need to make changes in production and consumption patterns and, in particular, the need to address poverty. The international Declaration on Cleaner Production is not just a piece of paper, it is a commitment and implementation is key. **Klaus Toepfer**

The International Declaration on Cleaner Production was launched at the Fifth High-level Seminar on Cleaner Production in Seoul in October 1998 to foster renewed dedication to Cleaner Production, which is a proven strategy for improving efficient use of natural resources and minimizing wastes, pollution and risks to human health and safety at the source. The Declaration has been signed by 40 national-level governments and by business and community leaders from around the world. There are signatories from over 70 countries.

Klaus Toepfer presided at the opening of the Seminar, where signatories included Atlas Cycles, the world's largest bicycle manufacturer (India), the International Council on Metals and the Environment, the Rocky Mountain Institute, an NGO based in the United States, the Canadian Chemical Producers Association, and the Aluminium Association of Canada. Signatures continued to be collected throughout the seminar. Among the new ones, commitments were made by organizations from Russia, Paraguay, Viet Nam, Malaysia, Sri Lanka and Mexico. Clifford Lincoln, Member of the Canadian Parliament, signed on Canada's behalf.

Milos Kuzvart, Minister of Environment, Czech Republic, and other government and business leaders contributed insights concerning their experience with Declaration implementation. The Declaration is a voluntary public statement of a commitment to practise Cleaner Production. The principles fall under the headings of leadership, awareness education and training, integration, research and development, communication and implementation. The Declaration's specific goals are to:

- *spread awareness* of current environmental problems, with Cleaner Production (and preventive strategies as a whole) the preferred solution;
- *renew and intensify commitment* to using Cleaner Production by society and community leaders;
- *diversify and broaden the client base* for Cleaner Production;
- *encourage Cleaner Production investments* beyond current demonstration activities; and
- *stimulate further cooperation* at the local and global level.

In promoting the Declaration, UNEP encourages more signatories, facilitates implementation, and gathers feedback and reporting on progress. UNEP's strategy has been to raise awareness and then to support implementation. It does so through promoting the collection of more signatures, developing Implementation Guidelines/suggestions for action, helping increase signatories' experience, and developing a Declaration Support Group to provide ongoing guidance.

Implementation Guidelines have been developed and distributed to each category of stakeholder: governments, companies and facilitating organizations. The Guidelines provide suggestions and give examples concerning over 300 different activities that could be used to promote Cleaner Production. To supplement the Guidelines, a collection of case studies illustrating experiences in the signatory categories is being developed.

In 2000, for the purpose of collecting feedback to guide future Declaration activities, the "Signatory Implementation Questionnaire" (adapted to the different signatory categories) was developed and distributed to over 150 signatories. All respondents indicated that they had undertaken activities in the areas of leadership and awareness, education and training. Respondents also noted that they applied tools from the Integration and Communication principles. Half the respondents had taken action to set goals for water and energy use, waste generation or air emissions, and had monitored and reported on progress. Half had also made financial investments in Cleaner Production. However, there were indications that more work is needed to improve the Declaration and to support signatories' implementation of Cleaner Production. Respondents considered the principle of research and development to be the least useful in helping to guide activities.

Initial results are encouraging. They will help UNEP structure Declaration support activities. UNEP will continue to collect and integrate feedback from Declaration experts – the signatories themselves.

In addition to the questionnaire, UNEP brought together 13 signatories from the different signatory categories to form a Declaration Support Group for provision of additional guidance. The Group has already provided valuable recommendations, which can be summarized as follows:

- *Obtain more signatories.* Given the amount of energy and interest in implementing Local Agenda 21, the Group suggested that UNEP focus on local-level governments in the future.
- *Facilitate implementation.* The Group suggested that case studies for each action point and each signatory category would greatly assist signatories. An opportunity to have their work presented in a UNEP publication would be an additional incentive for signatories to move from signature to action.
- *Improve feedback and reporting methodology.* Since reporting requirements for EMS and regulations are becoming increasingly onerous for industry, the Group suggested that feedback be drawn from currently available information.

The Support Group's ongoing input and endorsement of UNEP's proposed Declaration-related initiatives will help ensure the Declaration's continued relevance and increase global commitment to Cleaner Production and preventive strategies.

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Summary Report

This report summarizes the presentations and discussions at the Sixth International High-level Seminar on Cleaner Production (CP6), held in Montreal in October 2000. Participants came from over 70 countries. Each Plenary Session is described briefly. Highlights of Parallel Sessions are presented in the accompanying boxes. Edited versions of CP6 background papers appear in this issue of *Industry and Environment* as individual articles.

Opening ceremony, 15 October

Klaus Toepfer

"The primary challenge is to move from words to action ... Cleaner Production is not only about cleaning up production processes but about shifting these processes – and the products and services they provide – into more sustainable patterns." With these words *Klaus Toepfer*, UNEP's Executive Director, established the framework of the Sixth International High-level Seminar on Cleaner Production. His introductory remarks reflected the sense of urgency, but also of cautious optimism, that characterized the seminar.

Attended by 241 participants from government, industry, academia, UNEP, and National Cleaner Production Centres (NCPCs), CP6 acknowledged the many solid achievements during Cleaner Production's first decade. However, it also addressed areas where inroads have been limited. Looking to the short- and medium-term future, participants saw a need to consolidate and expand current Cleaner Production initiatives, and to use new approaches and new ways of thinking to meet future challenges. Reasons for optimism include the promise of new eco-efficient technologies and systems, as well as possibilities to use the synergies of regulatory, policy and market forces.

Participants were welcomed by *James Riordan* (Acting Director General, Toxics and Pollution Prevention Directorate, Environment Canada), who noted the impressive level of attendance from many parts of the world. Mr. Riordan pointed to the International Declaration on Cleaner Production as a very effective means of focusing the attention of governments and industries on the need to limit human environmental impacts. The new Canadian Environmental Protection Act emphasizes pollution prevention, which leads to Cleaner Production and to sustainable development.

Mr. Toepfer, referring to the Montreal Protocol on CFCs, the recent Biosafety Protocol, and a number of important international conferences on environmental issues, said that "Canada is a pioneer in working with other parts of the world to achieve environmental agreements." He paid tribute to the United Kingdom for hosting the first Cleaner Production Seminar in 1989, and to the Korean Government for hosting the most recent High-Level seminar in 1998. Concerning the International Declaration on Cleaner Production, he also mentioned the Malmo Declaration which resulted from a recent meeting of environment ministers. The Malmo Declaration emphasizes the need to change unsustainable modes of production.

Mr. Toepfer pointed out that the published total number of signatories does not include the many individuals who have now signed the Declaration. "They would be in the thousands," he said, "but we need still more signatories."

Milos Kuczaty (Minister of Environment, Czech Republic), who signed the Declaration in 1999, noted that a Cleaner Production-specific programme was approved by the Czech Government in February 2000.

During the opening Signing Ceremony in Montreal, four new signatories were added to the Declaration: *Ashok Kumar* (Senior General Manager, Atlas Cycle Industries Ltd., India); *Germano L. Vaz Hoette* (President, Aluminium Association of Canada); *Gary Stahl* (Secretary General, International Council on Metals and Environment); and *Amory B. Lovins* (Rocky Mountain Institute, United States).

In his keynote address, Mr. Lovins discussed the concept of "natural capitalism" – doing business as if nature (and people) were appropriately valued.

Plenary Sessions

Facing new challenges

Keynote speakers presented their visions of the challenges facing Cleaner Production, as well as sustainable production and consumption.

Clifford Lincoln, Member of Parliament, Lac Saint-Louis, Canada, who welcomed participants on behalf of the Government of Canada, felt that street demonstrations during the WTO meeting in Seattle and other international meetings related to trade and investment have sent the message that people are looking for change. The challenge is clear: it is to produce goods and services in a cleaner way. Mr Lincoln referred to work already done by Amory Lovins, Paul Hawkin and others showing that it is possible to produce less and waste less while making a profit and meeting real world needs. Waste, which is the greatest challenge – paradoxically – presents the greatest opportunity. The less business waste, the more profitable they can become.

Mr Lincoln cited several Canadian success stories:

- In 1992, Environment Canada signed a pollution prevention accord with the auto industry. DaimlerChrysler has since eliminated chlorine substances from production. Ford has eliminated lead and other toxic substances from its paint shops.
- The dry cleaning industry has signed an accord to reduce perchloroethylene, which has now been 60-70% eliminated.
- Ford and DaimlerChrysler are working with Canada's Ballard Power Systems to develop fuel cell cars.

Mr. Toepfer, referring to Amory Lovins' keynote speech the previous evening, re-emphasized the need to ask new questions and break out of current paradigms. He commended the Norwegian and German Governments, UNIDO, the Asian Development Bank and others for demonstrating a commitment to new thinking.

Mr. Toepfer highlighted several Cleaner Production issue areas:

- major environmental and social issues concerned with tourism and its increasing global impacts;
- further use of the banking and finance industry to promote Cleaner Production;
- defining the advertising industry's role. Given the traditional selling approach, which advocates more consumption, there is an apparent contradiction between advertising and Cleaner Production. However, some consumers are bringing an ethical dimension to their buying decisions. They want to know about environmental and social costs;
- persistent organic pollutants (POPs). On 19 December 2000, a POPs treaty was signed by 122 countries under UNEP auspices. The DDT issue suggests this issue's complexity: an immediate universal ban on DDT, which is used to eradicate malaria, is widely considered undesirable.

Mr. Toepfer also noted that technological opportunities would be an important element of the two-day seminar discussions. Better technology can facilitate application of the precautionary principle.

Keynote speeches were made by *Ronald H. Wever*, Vice President Environment, AT&T United States, and *Kalyan B. Nyati*, Head Environmental Management Division, Confederation of Indian Industries, who presented the industry perspective on challenges facing Cleaner Production. The keynote speakers shared a number of general insights regarding future challenges. These concerned:

- application of creative and systems thinking to Cleaner Production problems;
- analysis of the hidden dimensions of the Cleaner Production approach, as they relate to environmental, economic and social problems;
- analysis of Cleaner Production challenges and opportunities associated with the information technology revolution;
- increased partnering with business leaders and national industry associations to promote Cleaner Production;
- institutionalization of Cleaner Production at company level through integration with, rather than duplication of, current environmental management systems and reporting; and
- continuing to work to promote Cleaner Production in SMEs and large multinationals.

UNEP's International Declaration on Cleaner Production: from signature to action

The International Declaration on Cleaner P... duction was launched at the Fifth High-level Seminar on Cleaner Production in October 1998. To date, it has been signed by over 220 high-level signatories from national governments and business and community leaders from around the world. Signatories are from more than 70 countries. Three were 10 new ones during UNEP.

The International Declaration was the topic of one of the first Plenary Sessions. This session brought together speakers from different stakeholder perspectives and geographic regions to share insights and experiences concerning implementation. They stimulated discussion and outlined successes and remaining challenges.

Olivia G. O. Castillo, Asia Pacific Round-table for Cleaner Production, Philippines, commented that putting the Declaration into action requires building broader stakeholder awareness and bringing stakeholders together not only to develop capacities, but also to form partnerships. The greatest potential impact will be with respect to consumer trends. She recommended that companies consider:

- including a commitment to Cleaner Production within budgets (CP strategies with); and
- investing in the redesign of processes, products and even product-using Cleaner Produc...

Dr. Jo Gill, earlier cited activities and programme undertaken by the Asia Pacific Roundtable for Cleaner Production (APRCP) to implement the Declaration.

Highlighting the Declaration as a tool to implement Cleaner Production, e.g. the Declaration was a focal point at the third APRCP conference in Manila.

Olivia G. O. Castillo

- promoting sound networking, and linking all stakeholders in all areas of cleaner production policies, practices and programmes; and
- organizing seminars, workshops on the promotion of Cleaner Production.

To make the Declaration more effective, APRCP complements these components through demonstration, strong leadership, full commitment, budget support, public information, education and continuous assessment, which includes drawing from leaders to employees to consumers.

Dr. Jo Gill, earlier emphasized the continuous need for networking and exchanging experiences.

Claude Fussler, Director of Stakeholder Relations, World Business Council for Sustainable Development, noted that the WBCSD was one of the first signatories of the Declaration. Drawing on WBCSD uses the term "eco-efficiency" to describe its preventive philosophy and focuses its work on making the business case for sustainable development. Its membership, consisting of 130 transnational companies and 30 associate networks in many countries, gives WBCSD influence and access to industry. It is building capacity and sharing experience through workshops, publications such as the newsletter *Sustainability* and articles in *Tomorrow* magazine, and an eco-efficiency reporting platform on the web.

Mr. Fussler discussed two complementary business models that promote sustainability and competitiveness:

- *shared success*: shared values as a source of top growth and staying power (the theme can be summarized as "I cannot succeed unless society succeeds"); and
- *efficiency and innovation*: leads to leading edge competitiveness (waste and emissions are a sign of poor management).

He noted that the Dow Jones Sustainability

Claude Fussler

Raji Tadjudin

Parallel Session

Government Policies and Strategies

This session brought together representatives of different stakeholders from around the world to outline progress and future needs concerning Cleaner Production policies and strategies.

Theme speaker *Warren J. Evans* (Manager, Office of Environment and Social Development, Asian Development Bank, Philippines) observed that Cleaner Production has not had significant environmental impacts in Asia. Over 50 international organizations, national donors and NGOs promote Cleaner Production in the region. However, coordination of these efforts is woefully inadequate, as is the rate of adoption of Cleaner Production. Making information, skills and financing available is not enough; without underlying policies and planning, there is little hope for rapid adoption of Cleaner Production. Asian governments, he said, see Cleaner Production as a technical fix. They have not viewed or treated it as a policy issue.

Mr. Evans proposed the following conclusions:
- Until there is a meaningful level of enforcement of countries' environmental regulations, Cleaner Production will not work;
- Cleaner Production is not the domain of a single government agency, or of private sector manufacturing only;
- Business as usual is no longer possible or desirable in the promotion of Cleaner Production;
- Cleaner Production should be viewed in the larger context of poverty and public health; and
- Cleaner Production concepts should be mainstreamed into public policy in all sectors.

He added that tactical solutions will differ from country to country, but the approach should include identification of broad national goals by public and private stakeholders who work together to achieve them. Development of Asia-specific guidelines might also be worthwhile in regard to developing national policy frameworks for Cleaner Production.

Zhu Xingxiang (Director General, Department of Industrial Pollution Management, SEPA, China) reviewed SEPA's key strategies for promoting Cleaner Production in China. These are:
- development of a Cleaner Production indicator system and recommendation of technical criteria;
- formulation of supporting incentive policies to implement Cleaner Production;
- integration of Cleaner Production strategies into existing risk management regulations; and
- continuous development of new areas for Cleaner Production implementation.

S. Edward Mallett (President and Chief Executive Officer, Ontario Centre for Environmental Technology Advancement (OCETA), Canada) explained that OCETA is a not-for-profit organization providing business and technical services to small and medium-sized enterprises. The Centre is a delivery mechanism for government programmes. It is trying to shift the behaviour of SMEs towards Cleaner Production and sustainability. OCETA activities address issues such as climate change, clean air, clean water and waste reduction. Dr. Mallett focused on climate change programmes. OCETA can show how much capital expenditure is required to implement energy savings. Payback on investments begins after only two years, yet SMEs are not taking advantage of these programmes. Barriers are:
- existing financial burden;
- difficulty accessing financing (due to internal and external competition for funds); and
- limited time and expertise internally to consider programmes.

OCETA has developed a programme designed to address these barriers. The Eco-efficiency Innovation Programme provides two key services:
- a facility energy/eco-efficiency audit and evaluation of improvement opportunities (with government financing of up to 50% of the audit investment available to qualified manufacturers); and
- a Credit Facility to implement capital investment projects.

A pilot project targeting 25 SMEs in Ontario had positive results:
- 30 facility audits;
- over 90% of the options implemented;
- annual greenhouse gas reduction of 18,500 tonnes; and
- identification of R&D projects for process innovation.

Key success factors included the large network of trusted partners to access clients and a credible delivery agent. OCETA has decided to extend the programme to toxics reduction and pollution prevention.

Tarcisio Alvarez-Rivero (Economic Affairs Officer, UN Department of Economic and Social Affairs) emphasized the importance of integrating all policy frameworks in developing countries: business regulations, environmental regulations, industrial policy, etc. He described a three-step strategy used by UN DESA to implement cleaner technology strategies and promote Cleaner Production:

1. *Studies and diagnostics* identifies priority technology sectors with high growth potential, and for which government support may be most productive. It evaluates policy strategies in the region to assess the potential for promoting Cleaner Production, and identifies cleaner technologies as more competitive and sustainable substitutes for those in use.
2. *Business plans for sector-wide transfers of technology* includes cost/payback analysis, identification of possibilities for cost reductions through international support, and innovative financial mechanisms.
3. *Development of national policies and institutions for National Cleaner Technology Strategies (NCTS)* makes recommendations for changes in policy frameworks and institutional structures to support cleaner technology.

Mr. Alvarez-Rivero concluded that "We are just beginning to understand how all these policy aspects – economic, R&D, environmental – work together, but if we don't integrate them we will fail."

Jean Cinq-Mars (Head of the Pollution Prevention and Control Division, OECD Environment Directorate), commented that Cleaner Production depends on several factors:
- social and market factors that often precede or supersede public policy;
- external technology; and
- getting the prices "right".

An important role for government is to lead by example through such initiatives as sustainable purchasing policies and the development and implementation of sustainable development strategies by public institutions.

who interact with supervisors on the shop floor.

Among the next steps for the Declaration, speakers mentioned the following:
- using the Declaration to factor a culture of environmental accountability into decision-making;
- keeping the Declaration fresh through dialogue and implementation;
- using the Declaration to integrate Cleaner Production/eco-efficiency into the complete value chain, thereby leading to an improved quality of life;
- including commitment to Cleaner Production in company financial budgets; and
- developing appropriate training programmes for senior managers, middle managers and supervisors.

Technology innovations and Cleaner Production

This Plenary Session was aimed at outlining the role technological innovation can play in achieving Cleaner Production and, beyond that, sustainable development, recognizing that such innovation is only one of the driving forces. Specifically, the session reviewed trends in technology development from a Cleaner Production perspective. Speakers came from different stakeholder groups and geographic regions of the world. The needs and potential of technology assessment approaches were also discussed.

The theme speaker, *David Minns* (Director General, National Research Council, Canada), emphasized that "invention plus deployment equals innovation". Invention – the outcome of

Mr Cinq-Mars identified current challenges to Cleaner Production, involving issues such as:
- non-point source pollution;
- dissipative waste;
- impacts of service industries;
- consumption patterns;
- nitrogen management regime;
- carbon management; and
- trade policy and the environment.

He also emphasized that achieving policy coherence and international cooperation is necessary if the issue of Cleaner Production is to be addressed effectively.

Sandor Kerekes (Director, National Cleaner Production Centre, Hungary) commented that the "low-hanging fruit" – i.e. Cleaner Production opportunities that are relatively easy to seize – are not really low-hanging at all since perceptions and behaviour are difficult to change. Professor Kerekes added that, in the short term, Cleaner Production will be achieved through a combination of preventive and end-of-pipe technologies.

Communicating the fact that end-of-pipe technologies are more expensive is the educational challenge for Cleaner Production advocates. At a more profound level, industry and governments need to achieve an understanding of systems thinking: the ecological system is the all-encompassing one, with cascading subsystems and sub-subsystems (social system, economic system, industrial system and so on). Systems' interdependence cannot be broken.

Sang Eun Lee (President, Korea Environment Institute) reviewed Cleaner Production progress in Korea since it hosted CP5 in 1998:
- Basic environmental policy has changed from end-of-pipe to a pollution prevention approach;
- A programme has been developed to minimize pollution in the production process;
- There are pollution prevention agreements between government and industry;
- A "green building" certification system is in place;
- Extended producer responsibility will be in place by 2001 for household appliances, and by 2002 for computers;
- Voluntary emission reduction systems have been developed;
- Incentives for Cleaner Production include government financial assistance;
- Cleaner Production guidance materials have been published; and
- An R&D programme for Cleaner Production is under way.

The chairperson of this session, *Victor Shantora* (former Director, Toxics Pollution Prevention, Environment Canada), summarized the presentations as: "Yes, we have moved the Declaration from signature to action, but it is a qualified yes." He heard calls for greater integration of government environmental policies with other areas, more inclusiveness and involvement of all stakeholders, and use of the full toolbox of regulatory, policy and market instruments. Incentives and technical support, now provided by some governments, are key.

During the general discussion, participants focused on the need for – and challenge of – behavioural changes. It was agreed that information and technology are not sufficient to effect change. The limits of several common approaches to changing behaviour were noted. For example, consumer participation in boycotting products for ethical or environmental reasons is typically very low. Or when new regulations are written (the traditional way governments try to bring about positive change), businesses often try to identify more loopholes. The following suggestions for facilitating behavioural change were made:
- changing planning processes to focus on social and economic effects of industrial policy;
- empowering local communities to stimulate change among hard-to-reach small industries;
- use by larger companies of their credibility, influence and technical capacity to effect behavioural changes in their customers through the value chain;
- considering the benefits of developing strong industrial associations for SMEs;
- learning from the successes of industry safety programmes in changing workplace cultures; and
- mainstreaming Cleaner Production by integrating it into core business university curricula, engineering, finance, business administration, etc.

A range of views were presented on developing countries' specific challenges and needs:
- Communities in developing countries may not have the same level of "empowerment" as those in industrialized countries, so governments must lead by putting enabling subsidies in place in the short and medium terms;
- Democracy and "cleaner leadership" are critical in bringing about change;
- Inclusion of business associations (which may have real political power in developing countries) in policy discussions should be ensured; and
- In the areas of technology transfer, donations or investment, one should start with the local needs of recipient countries, not with what the donor country happens to have on offer.

The findings of the background document on "Policies and Strategies for Cleaner Production", prepared by Professor Thomas Lindhqvist of Lund University, were generally accepted. Cleaner Production can be promoted by a wide range of policy instruments, ranging from direct regulation to economic/market-based and information instruments. Most are not specific to Cleaner Production. Appropriate combinations therefore need to be made to favour Cleaner Production specifically.[1]

Recommendations

- Integrate Cleaner Production into all public policy domains;
- Developing countries should base industrial planning on Cleaner Production principles;
- Governments of developed countries should lead by example, through initiatives such as sustainable development strategies for public institutions and sustainable purchasing policies;
- Exploit all the tools available to reward Cleaner Production and discourage end-of-pipe solutions, including tax policies, subsidies, voluntary agreements, regulations;
- In developing countries, link Cleaner Production to the most urgent priorities, particularly poverty and public health;
- Change planning processes so that they also focus on the social and economic effects of industrial policy;
- Ensure meaningful enforcement of regulations;
- Empower local communities and local leaders to stimulate changes in industrial behaviour;
- Learn from successful safety programmes in industry how to change organizational cultures and individual behaviour; and
- Mainstream Cleaner Production by integrating it into core university curricula (e.g. engineering, finance, business administration).

1. See page 41.

R&D and technological development – provides the "technological push". In Cleaner Production, technological push is occurring in the areas of eco-efficiency, design for the environment (based on life-cycle analysis, or LCA) and emerging systems technologies. Biotechnology is a key systems technology with great promise for achieving sustainable industrial development.

Deployment – commercialization of the invention – provides "technological pull." However, technology is not enough to drive Cleaner Production. Market demand (e.g. improved or sustained profitability/competitiveness and consumer good will) and government policy (e.g. purchasing policy, product labelling, liability legislation) are also needed. Market forces can stimulate change in the shortest timeframe.

Dr. Minns focused on environmental life-cycle analysis (LCA) as a key tool for measuring technologies' Cleaner Production performance. He referred to a case study comparing greenhouse gas emissions associated with traditional gasoline and gasoline with 10% bioethanol fuel. One LCA indicated that the environmental impacts of the latter were less great. However, a sustainability analysis, which adds a time component, indicated that the opposite was true. He also looked at the issue of the sustainability of innovation, suggesting a way to assess the environmental performance of new technologies when they enter the market. In order to address the question "What environmental performance will be required to keep the environmental footprint of the economy at a cer-

stant level?". Dr. Minns listed four assumptions:

- Environmental impacts are proportionate to economy activity;
- Economic growth occurs at a rate of 4%;
- Increased eco-efficiency decreases environmental impact at a given level of economic activity; and
- If newly developed technology is beginning to be introduced into industry, an average of 25 years will be required before it becomes the average performance of industry as a whole.

Given the last assumption, technology entering the market today should have a performance at least three times better than the current industry average (i.e. emissions that are 33% of current ones) to be sustainable. If present environmental impacts are not sustainable, of course, environmental performance targets for new technologies will have to be even higher.

Dr. Minns stressed that the issue is not cleaner vs. clean enough. Both are needed. Cleaner Production is a crucial concept that mobilizes industry to respond with innovation to the challenge of improving environmental performance. At this stage, Cleaner Production would benefit most from "front-wheel drive" policies aimed at market deployment or technological "pull".

David Minns

John F. Jaworski (Senior Industry Development Officer, Industry Canada) presented a table showing that the use of conventional processes and non-renewable feedstocks is not sustainable. Bioprocesses and bioproducts offer "a way to go back to the future" – i.e. a way to achieve sustainable development. Biotechnology is playing an increasingly important role in the chemical industry; biocatalysis (the use of enzymes or microorganisms to synthesize or modify molecular structures) is becoming part of the general tool kit of synthetic organic chemists. BIOCHEMIE, a subsidiary of Novartis, reported that in the production of one tonne of cephalosporin, the conventional chemical process resulted in 31 tonnes of wastes requiring incineration while its new enzyme biocatalysis process resulted in only 0.3 tonnes.

Dr. Jaworski discussed the move to a "biobased economy." Such a global economy, based on biofuels and biochemicals, offers opportunities for both developed and developing countries. Biotechnology-based technologies in particular, and the life sciences in general, will play an increasingly prominent role in moving global production systems towards the ultimate goal of sustainability. Research communities in various disciplines, national and international agencies,

Parallel Session

National Centres: Delivering Cleaner Production

This session was chaired by *Margaret T. Chinambora* (Secretary for Mines, Environment and Tourism, Zimbabwe). The theme speaker was *Edward Clarence-Smith* (Team Leader, Sectoral Support and Environmental Sustainability Division, UNIDO). The panellists were *Hans-Peter Egler* (Deputy Head, SECO, Switzerland), *Guillermo Roman* (Director, NCPC, Mexico) and *Martina Motlova* (Director, Global Relations Department, Ministry of the Environment, Czech Republic).

The background paper[1] and theme presentation suggested that even if National Cleaner Production Centres (NCPCs) have generally been successful as promoters of Cleaner Production, a number of constraints still need to be addressed if their goals are to be met fully. Centres' goals and objectives were identified as:

- awareness raising;
- training;
- technical assistance;
- information dissemination;
- investments in Cleaner Production technology; and
- policy advice.

The constraints identified in the theme presentation were further elaborated upon and added to by the panellists and participants. Discussions on each issue can be summarized as follows:

Centres' self-sustainability

NCPCs are expected to become financially self-sustainable after an initial start-up period of a few years. However, since the actual business demand for Cleaner Production is still poor in many countries, there is a risk that they will have to deliver services in areas not directly related (such as ISO 14000 and Environmental Performance Indicators) in order to achieve self-sustainability. Some participants noted that it is of less importance *how* the Cleaner Production concept is promoted (in combination with other environmental tools, or on its own) than that it *is* promoted. It may even be desirable for other mutually reinforcing tools to be promoted at the same time.

Another issue relating to NCPCs' self-sustainability is their integral goal of "training the trainers," i.e. building capacity in other companies and organizations so as to deliver Cleaner Production services to the industry. A concern is that the companies and consultants trained may in the long run become competitors of the NCPCs and put them out of business. Most comments on this issue supported the idea that centres' sustainability is not an end in itself, but that capacity building and promotion of Cleaner Production are. If the capacity building undertaken by NCPCs results in a strong group of Cleaner Production service providers, this is actually a positive development. NCPCs may still be able to survive, not as providers of Cleaner Production services to industry but as "centres of excellence" supplying other providers with the latest information and training.

The issue of government financial support for centres was also discussed. While a few centres may receive public funding, seemingly because their work is seen by governments as important enough to receive state funding, the majority need to become business oriented to survive in the long term. This was widely agreed by participants. It was pointed out that in order to develop a sustainable Cleaner Production market, it is important that the service provided by centres never be given away (although discounted services may be provided in the beginning to attract customers). "A commodity provided for free is never valued."

Local companies in some countries *do* pay fees to local consultants. A related suggestion was that NCPCs that help international consultants access local Cleaner Production markets should charge for this service, thereby servicing the local market and also increasing NCPC revenues. Finally, it was pointed out that in some countries it may still take a long time for NCPCs to achieve self-sustainability simply due to the country's low level of economic development.

Limitations on NCPC activities

The Cleaner Production concept emphasizes improvements that can be achieved with non-technological options, such as good housekeeping and process control. However, transferring clean technology was also seen as a necessary "next step" that must be taken by all centres sooner or later. While this point was not disputed, it was noted that NCPCs cannot provide the sector-specific and highly specialized technical knowledge often required for this task (since the few centre staff members wear the hats of gener-

John F. Jaworski

associations and NGOs have developed Cleaner Production initiatives. Some networks, such as that led by UNEP, have begun to emerge. These stakeholders need to communicate with each other and work together to develop and implement global solutions to global problems.

Mentor E. Poveda (Latin American Energy Organization, OLADE) stated that for some years his organization has been working with other countries in Latin America and the Caribbean on a project relating to energy and sustainable development. OLADE has produced a guide for sustainable energy policy-making. The low efficiency of technologies in the region indicates that there is considerable room for improvement. However, the region's environmental concerns involve other priorities. New approaches are needed to develop energy efficient strategies in Latin America, and outside help will be required to implement such approaches. For example, should developed countries penalize companies that export old cars and outdated plant technology to the region?

Kenichi Sakamoto (UNU/ZERI Project Advisor, Japan) presented eight Japanese Cleaner Production case studies from industry sectors including metal finishing, iron and steel, pulp and paper, and beer manufacturing. Dr. Kenichi

Mentor E. Poveda

alists, salesmen, lobbyists, etc). One solution would be to allow regional (sub-national) centres to specialize in different sectors. UNEP's working groups could also be better utilized by centres for this purpose.

A general weakness of the NCPC approach is that centres too often focus on supplying services without addressing the issue of how to create a demand. In this context, the discussion touched on the issue of what might happen to "public goods" if the centres only delivered "private goods" as a result of becoming business-oriented. It was suggested that since the win-win character of Cleaner Production combines environmental benefits (public goods) and economic benefits (private goods), the "public goods" will not be lost.

NCPCs may also find a substantial source of income if they provide services for improving energy efficiency and link this to the anticipated carbon trading schemes and flexible mechanisms under the Kyoto Protocol.

Critical mass and networking

The question was raised whether NCPCs are too few and far apart to have an impact on industry and society. This issue reinforced the need for NCPCs to prioritize capacity building so as to achieve a critical mass of Cleaner Production promoters and practitioners. More regional and sub-national centres would be very useful in this regard. In the long run, however, to be widely accepted the concept needs to be perceived by both the public and private sectors as providing added value. The importance of achieving this credibility is underlined by the fact that areas where Cleaner Production can be applied may vary widely from one country to another (e.g. sectors such as tourism and agriculture are major income earners in many countries, but with a few exceptions the concept has focused on applications in manufacturing industry).

There were calls for closer and more active networking among centres. The challenge in this case would be financing. It was noted that regional roundtables, UNEP's Cleaner Production working groups, and universities are information sources that are not well utilized by NCPCs. This again brought up the question of whether too much is being asked of centres. Much of the expertise on specific issues could be generated and accessed through a closer network, not only among NCPCs (and regional and sub-national centres) themselves, but also working more closely with regional roundtables, working groups and universities.

Centres as policy advisers

It was widely accepted that bringing about widespread adoption of Cleaner Production in society will not only require training, awareness raising, information dissemination and technical/financial assistance, but also changes of policy by national and local governments. To achieve this, NCPCs need to access the highest political levels of decision-making – which is often not only time-consuming but also very difficult. Several participants noted that other actors should work together with NCPCs to address this issue, including UNEP/UNIDO, other practitioners (consultants) and industry associations. Even if the centres do not have the capacity to spend an ideal level of resources on addressing policy issues, they can still seek to influence policy-makers as an integral part of their work.

The road ahead

Several participants expressed appreciation for the succinct analysis of present challenges to NCPCs presented in the background paper. A widely supported proposal was made to take this discussion beyond CP6 by turning the background paper into a questionnaire that could be distributed and commented on by participants and other interested parties. The information collected would provide valuable input to further development of the NCPC network.

Recommendations

- For long-term sustainability, NCPCs need to operate on a business basis. Services provided by NCPCs should always be offered on a fee basis.
- Providing cleaner technologies is a necessary "second step" in the development of NCPCs. Highly specialized expertise can be created when each centre specializes in only a few areas, complemented by close networking with other centres, UNEP working groups and universities.
- NCPCs are not an end in themselves. Creating capacity (and demand) for Cleaner Production services is a priority. NCPCs' "new role" would be to support other Cleaner Production providers with the latest know-how.

1. See page 48.

observed that these cases make it clear that technology is one method of reaching the goal of Cleaner Production. However, it is very important that policies be closely linked with market forces so that they reinforce each other.

The panellists submitted the following general comments:

- Policies should be developed aimed at market deployment or technical "pull" to drive Cleaner Production. Technological innovations can drive sustainable production.
- Socio-economic market responses and policy framework factors need to be accounted for in the assessment of technology application;
- Techno-economically proven technological innovations should be commercialized for easy access and effective outreach;
- Advantage should be taken of emerging opportunities for bioprocesses and bioproducts to achieve a quantum leap in eco-efficiency;
- A guide should be produced for energy policy-making with a view to sustainable development;
- Penalization of companies that export out-of-date plant technologies should be considered, if necessary;

Suren Erkman

- New strategies to achieve energy efficiency need to be devised; and
- It should be ensured that biotechnology is included in discussions about, and evaluation of, Cleaner Production initiatives and strategies.

Twinning industrial ecology and Cleaner Production

To launch discussions on the second day, *Suren Erkman* (Director, Institute for Communication and Analysis of Science and Technology (ICAST), Switzerland), delivered a keynote address on industrial ecology. Cleaner Production and eco-efficiency remain targeted towards manufacturing processes and business strategies within industrial companies. However, Cleaner Production could be applied at the level of a cluster of various companies, an industrial zone, or even a whole region (that is, it could be applied at the level of a system). This emerging approach has become known as "industrial ecology." The ultimate goal of industrial ecology is to determine how the industrial system could be restructured to make it compatible with the way natural ecosystems function.

Parallel Session

How to Finance Cleaner Production

The chairperson, *Sriratana Tabucanon Monthip* (Deputy Director-General, Department of Environmental Quality Protection, Thailand), opened this session by pointing out that statements of commitment need to be translated into action. Adoption of Cleaner Production will not spread unless corresponding financial flows are ensured. The current pattern of pay-as-you-go is not sustainable in the long run. She referred to the background paper prepared by Ari Huhtala (Project Manager, CP Financing, UNEP DTIE) highlighting, in particular, the importance of elaborating a definition for Cleaner Production investments and embedding the terminology in the financial services industry in the same way as environmental management.[1] The session rapporteur was *Jurgis Staniskis* (Director, Institute of Environmental Engineering and Cleaner Production Centre, Lithuania).

The theme speaker, *David Hanrahan* (Programme Team Leader for Urban, Industry and Energy, Environment Department, World Bank), emphasized that the Bank encourages lending in financial competitive terms, i.e. it discourages perverse subsidies. He reiterated the importance of the language issue and integration of Cleaner Production into the enterprises' financial decision-making. He also called for improved accounting practices and policy changes conducive to selection of Cleaner Production options. He felt that Cleaner Production is happening on a much larger scale than usually perceived, as much of this change is funded directly from companies' own resources. Communication problems persist between those seeking external funding (e.g. loans) and the supply agents.

Eric K. Mugurusi (Director, Department of Environment, Government of Tanzania) presented the perspective of a developing country in which newly privatized enterprises are producing basic goods and require assistance to improve their technologies. He stressed the need for an ongoing educational process to help enterprises prepare "bankable" investment proposals attractive to financial services. He called for donor-supported and national revolving funds to jump-start the adoption of Cleaner Production in developing countries, thus rewarding pioneers and initiating good examples. He also

Parallel Session on financing Cleaner Production

Sustainable consumption and Cleaner Production: two sides of the same coin

This Plenary Session targeted consumers' roles in the product chain with respect to identifying what governments, businesses and other organizations need to know about consumer behaviour and trends, so as to successfully design and communicate about Cleaner Production products and services.

Chris Ryan (Director, International Institute for Industrial Environmental Economics (IIIEE), Lund University, Sweden), the theme speaker, introduced the session by noting that consumption is currently taken as a measure of prosperity. The great inequalities in global consumption send a disturbing message, but there are grounds for hope that inequalities will be reduced and unsustainable consumption curtailed. Polluter-pays policies and extended producer responsibility will contribute to making eco-innovation a business priority. Recent surveys of industry suggest that a reordering of priorities is beginning to occur.

A potential problem is that efficiency improvements could become a trigger for increased consumption. Eco-efficiency will not lead to a sustainable future unless consumption levels fall globally. This does not necessary imply a 'winding down' of the economy. In industrialized countries it means a shift from an emphasis on quantity to one of quality in consumption. The most prevalent consumption approach is material (management), whose success depends on a feedback mechanism that is information rich and extremely attuned.

Product innovations such as multi-functionality, extended life products, dematerialization and even e-materialization can all work to make consumption more sustainable. De- and e-materialization must be viewed with some scepticism. The overall result of reducing net materials use is not clear. For example, there are limits to miniaturization. However, there is evidence that some consumers are willing to shift to e-materials.

Professor Ryan also addressed other approaches to reducing consumption:

- *Re-use and remanufacturing*. In some cases, Xerox has achieved an increase in materials use efficiency greater than factor-4 by 'dematerializing' itself as a service company. The Xerox approach reflects a wider trend elsewhere in manufacturing.

Chris Ryan

highlighted the particular difficulties faced by SMEs due to high interest rates and cumbersome loan application procedures.

Luis Enrique Berrizbeitia (Executive Vice-President, Corporacion Andina de Fomento (CAF), Venezuela), who expressed his general agreement with the points raised in the background paper, provided examples of environmental lending and financial intermediary training programmes provided by CAF. He felt that problems faced by SMEs are generic and not related to Cleaner Production investments only. The importance of an enterprise's competitiveness and the determining character of the market were emphasized. Links between poverty and environmental degradation were also mentioned.

Mike Kelly (Environment Manager, KPMG, United Kingdom) described the process of carrying out the UNEP DTIE survey on past Cleaner Production investment practices. He noted the main conclusions, also summarized in the background paper. He felt that a strict definition of Cleaner Production investments is not required, but rather expansion of a new culture through education, including the media and business schools. Cleaner Production investment should be seen as an integral part of a process, not just a component. Mr. Kelly also cited examples of SME guaranteed funds that have proved unsuccessful in terms of finding borrowers.

Sybren de Hoo (Director Sustainable Development, Rabobank, The Netherlands) considered the background paper a good basis for discussion. He felt that projects should have their own cash flows and risks. Most projects currently presented to Rabobank are not bankable projects. In the case of Cleaner Production projects, environmental revenue sometimes relates to political decisions and so presents an additional risk for banks. Mr. De Hoo recommended that the outcome of the UNEP DTIE Cleaner Production Financing project be submitted to the signatories of the UNEP Financial Institutions Statement on Environment and Sustainable Development, in order to solicit innovative mechanisms and proposals for solutions.

Dr. Monthip described recent developments in Thailand, including the embedding of Cleaner Production in the 9th National Economic and Social Development Plan (2001-2006) and approval of a technical assistance project funded by the Asian Development Bank to support the establishment of a National Centre for Cleaner Production in Thailand, with the objective of assisting in information networking and promotion of financing mechanisms for Cleaner Production.

The presentations and subsequent discussion resulted in the following conclusions and recommendations.

Conclusions

- There has been considerable progress in implementing Cleaner Production investments coming from companies' own resources. A communication gap remains, however, between demands for external funding and their sources.
- Language can be a major barrier with respect to introducing the concept to new audiences. It is also crucial in meeting the criteria of specific funds or facilities for Cleaner Production investments. Language is less of a problem at the level of commercial investment projects.
- Cleaner Production investments require a basic capacity level in a country. Otherwise, there is little demand from industry for Cleaner Production assistance and little assistance available to firms that are interested. This basic capacity is a prerequisite in choosing countries for active Cleaner Production investment promotion initiatives.
- There are examples of successful special funds for environmental and/or Cleaner Production investments, but it is recognized that the process of integration into the market requires a certain period of time.

Overall recommendations

- Cleaner Production should be embedded in government policies to encourage commercially competitive Cleaner Production investments and to discourage perverse subsidies.
- Accounting practices in enterprises should be improved to reflect more accurately the actual cost of waste management and external environmental costs.
- Concerted efforts are needed to strengthen the capacity of financial institutions, business schools, academia and the media to understand the benefits of preventive approaches.
- Enterprises, particularly SMEs, need to be trained to prepare creditworthy investment proposals.
- Revolving funds and other targeted investment facilities should be encouraged to jump-start the implementation of bankable Cleaner Production investments, particularly in developing countries.

1. See page 56.

Parallel Session

The Strategy to Implement Multilateral Environmental Agreements (MEAs)

The theme speaker, *Per Bakken* (formerly Officer-in-Charge, UNEP Secretariat of the Basel Convention, Switzerland), noted that the basic philosophy of Cleaner Production is that it is better to prevent and cure, and that the best place to implement preventive strategies is at the source. However, early MEAs were technology driven agreements that focused on end-of-pipe solutions. Recent MEAs offer a more flexible approach to solutions, and therefore more opportunities for Cleaner Production.[1] Mr. Bakken divided MEAs into total bans (e.g. the Montreal Protocol, the proposed POPs Convention) and pollutant reduction conventions (e.g. the Basel Convention, FCCC, LRTAP).

Reduction targets have the greatest potential to promote Cleaner Production. Mr. Bakken highlighted UNEP's Regional Seas Programme to control marine pollution as being of interest to most NCPCs around the world. He concluded that there is significant scope to use Cleaner Production methodologies as a means to achieve national commitments under MEAs.

Tony Hetherington (Deputy Chief Officer, Secretariat of the Multilateral Fund for the Implementation of the Montreal Protocol, Canada) emphasized that work now under way to implement the Protocol does indeed represent Cleaner Production activities. He added that the Montreal Protocol does not demand the cleanest production – it represents the "art of the possible." The challenge of phasing out ozone depleting substances is driving technology improvement in both developed and developing countries. The result has frequently been improved efficiencies and an increased bottom line. The Multilateral Fund has catalyzed equipment development. However, there are major funding issues, particularly the need for focus and fund accountability versus achievement of broader goals. MEA challenges cannot be met by throwing money at them; there needs to be full stakeholder participation and responsibility.

Professor James Salzman (Washington College of Law, United States) agreed with Mr. Bakken that more recent MEAs offer great potential for Cleaner Production approaches. He called on UNEP DTIE to work with convention secretariats on such practical issues as funding and technical assistance. He emphasized that the focus should be on what an MEA can achieve that national actions alone cannot. He added that there is a good chance the Global Environment Organization (GEO) will occur, a major opportunity for Cleaner Production and for interaction among MEA secretariats.

Viera Feckova (Director, NCPC, Slovak Republic) emphasized that seizing Cleaner Production opportunities represented by MEAs requires interaction with all stakeholders – governments, large companies and SMEs. Also important is clarifying the role of each player (NCPCs, Cleaner Production activists, governments, polluters).

The chairperson, *Stephen O. Andersen* (Director, Technology Transfer and Industry Programmes, Office of Air and Radiation, US EPA), commented that one of the lessons of the Montreal Protocol is the value of a technical advisory panel. Involvement of experts from business was the key to technical success in implementing it.

In the general discussion with participants, the following points were made:

- UNEP should interact more with convention secretariats;
- MEAs bring government commitment and probably money to the table, while Cleaner Production players should bring knowledge and leadership to the table;
- Sectoral strategies are needed;
- The role of NCPCs and Cleaner Production activists is transferring not just technical assistance but also capacity building; and
- UNEP DTIE should organize a kick-off workshop to bring MEA stakeholders together to identify common areas of action, or where Cleaner Production programmes could support and facilitate implementation of specific conventions.

1. See page 54.

There are sound business reasons for maximizing machines for longer life and low maintenance.

- *Pay for service instead of buy to own.* Services *per se* are not eco-efficient. While services are perceived as transitory, the infrastructure and materials used in traditional services are probably quite unsustainable. The service sector has generally not been targeted for preventive strategies. However, the service concept is a very good way for businesses to think about change, as the focus on use has very important implications for product design.
- *Informational feedback.* The act of consumption traditionally connotes a change of product ownership (and responsibility). Informational feedback in product design has been ignored. Pay-by-use approaches fit well with informational feedback. In the case of pay-by-use washing machines, the electricity supplier is also the information supplier with respect to use patterns and machine performance.

Professor Ryan noted a recurring theme regarding the above approaches: information technology is possibly the most critical factor in achieving improvement. Culture is another critical factor. For example, a pay-per-use washing machine breaks down traditional business boundaries but may not work in a different place or culture. To work, the pay-by-use approach must be more desirable for consumers than traditional purchasing. Redirecting desire gets back to advertising and UNEP's discussions with the advertising industry, in which the need for advertising as an industry to work in tandem with product designers has been emphasized.

Designing to conform to consumer desires is the key to market success. There were many questions concerning the education and training of designers and the values of consumers. A heated debate also took place on the human need for ownership and whether it is an immutable part of human nature. University students may not identify with a need to own, at least while they are young. Another encouraging sign is that consumers in a number of industrialized countries have shown a striking willingness to spend time separating waste. More such opportunities for consumer involvement need to be generated.

Diane Dillon-Ridgley

Diane Dillon-Ridgley (on the Board of Directors of Interface Inc., United States) told how her company's service-lease approach fosters sustainable consumption. Interface is the world's largest manufacturer of modular carpeting, with annual sales of $1.3 billion. It is a solution provider for commercial interiors, providing a floor-covering service rather than selling carpets outright. For a monthly fee, Interface takes responsibility for maintaining fresh and clean carpeting at all times, replacing worn carpet tiles as needed.

Interface has been committed to sustainability since 1994. It is striving for sustainability on seven fronts:

- *eliminate waste* – elimination of the concept of waste, not just incremental reductions;
- *benign emissions* – elimination of molecular waste emitted with negative or toxic impacts on natural systems;
- *renewable energy* – reduction of energy use while

Parallel Session

CP Information: the Importance of InterNET-WORKING

The rapporteur for this session was *Mark Kasman* (Senior International Information Officer, US EPA). The theme speaker, *Chaiyod Bunyagidj* (Vice President, Thailand Environmental Institute), suggested that the goals of networking are different at the global, regional, national and local levels. The stakeholders of networking include government, business, industry, NGOs, academia, international organizations, donors and society at large. However, different stakeholders have different needs, which raises the question of what is to be achieved by networking. Should it

- provide "free" information dissemination?
- create core exchange/discussion groups on Cleaner Production? or
- become a bulletin board for the region?

Mr. Bunyagidj pointed to a variety of ways to network, including the Internet, printed materials, seminars, training and roundtables. Key success factors include:

- a committed and knowledgeable Cleaner Production person with good communication skills;
- personal contact (much easier at country and local level); and
- simple terminology.

Barriers include:

- the very passive nature of Cleaner Production information;
- lack of hardware/infrastructure;
- lack of knowledge of (or interest in) the Internet;
- lack of common issues to bring all stakeholders together;
- language; and
- lack of ongoing funding support.

Mr. Bunyagidj concluded by reiterating the importance of further clarifying networking goals.

Frank Rittner (formerly Programme Manager, World Bank; Global Environment Facility (GEF) Secretariat) described the Sustainable Technology Alternatives Network (STAN), an electronic information and facilitation service being developed through a partnership between GEF and UNEP. The goal is to identify and address key barriers to the introduction, commercial transfer and global market development of viable technology alternatives. Barriers include:

- lack of awareness concerning global environmental agreements and technology/business alternatives that meet convention objectives;
- isolated efforts to implement conventions;
- lack of access to up-to-date technologies;
- lack of business planning know-how;
- lack of access to finance and risk capital for investments and ventures; and
- lack of incentives for considering alternatives.

STAN will provide added value not available on the Internet. It will organize, verify and customize information relating to specific business needs, and will offer interactive business planning tools and discussion groups. Specific services under consideration include: on-line technology comparison/assessment; integrated business planning advisory services; information on financial tools and investment risk-management tools; integrated trade policy advisory services; on-line marketing and procurement engines for cleaner technology; distance learning tools; and dialogues online. Mr. Rittner indicated that a business plan for the service will be completed by March 2001 and a network proposal submitted by the following May. GEF and UNEP want to start services by August 2001.

Hans Schnitzer (Joanneum Research, Austria) defined network success as bringing the right information to the right people at the right moment in the right language – an achievement more difficult than it sounds. The right moment is when people are open to receiving information and have the power to use it. Information has to be in simple language that the target group can understand. SMEs, for example, are not going to use the Internet to read about a new subject in a foreign language. Information needs to be "new" for the target audience; old information can be relevant to a particular target group. Professor Schnitzer agreed with Mr. Bunyagidj that networks are needed at different levels, such as local/community-based, theme-oriented (e.g. Cleaner Production or energy), regional, national and international.

Julia Alice Ferreira (Manager, P2 Office, CETESB, Brazil) discussed the challenges of networking in Latin America and the Caribbean, where Cleaner Production approaches differ from country to country. Barriers to networking include lack of financing sources and lack of information in local languages. Creation of a New Americas Cleaner Production network could provide a helpful tool. However, the success of the network will require a committed group providing support to target audiences; simplicity and attractiveness to users; finding and keeping partners motivated to provide and update data; sustainable funding; and a marketing programme to reach the public.

In the general discussion with participants, the following points were made:

- Some participants agreed with GEF that a charge is justified for a value-added service, while others saw fee-for-service as a barrier to networking. It was suggested that advertisers be charged but not users, who would be discouraged from using the system when they did not know the value of the information they would be paying for.
- Many developing countries do not have access to the Internet. Funding agencies should make relevant journals available to those countries in local languages.
- The target audience should not be SMEs, which do not have the time or interest to surf the net, but their intermediary or extension service provider.
- The issue of liability for information provided through these networks needs to be considered.

Several networking initiatives were noted:

- Thai MOSTE is setting up an information centre with the support of the Asian Development Bank, as well as cooperating with UNEP in Japan and with the Japanese Government to promote the ASEM Technology Centre. They are also cooperating with RIET in Singapore.
- US AID has put together a CD-ROM on their technical Cleaner Production case studies, which they would like to make available. The difficulty of getting this information out to recipients amid the "flotsam" of the Internet was noted.

The chairperson, *Terri Willard* (Coordinator for Sustainable Development Communications Network, International Institute for Sustainable Development (IISD), Canada), reviewed key themes from this session:

- There is a difference between a network and a web site.
- Shaping the message to the particular audience is important.
- Matching a suite of communications products and services to the audience is a challenge.
- Any network needs an internal and external communications strategy.
- It is important to decide whether to create new content or package existing information for target audiences.
- There is a need to avoid duplication.
- Marketing continues to be a challenge.

Recommendations

- Match information to target needs of different audiences.
- Establish networks in addition to websites.
- Avoid duplication by building on existing systems.

See the article by Marianne Lines on page 68.

replacing non-renewable resources with sustainable ones;

- *closing the loop* – redesign of processes and products to create cyclical material flows;
- *resource-efficient transportation* – exploring methods to reduce transportation of molecules (products and people) in favour of moving information;
- *(electronic) hook-up* – creation of a community in and around Interface that understands the functioning of natural systems and our impact on them;
- *redesign of commerce* – focusing on the delivery of service and value instead of delivery of material.

Amel Benzartim (General Director, Tunis International Centre for Environmental Technologies and the Tunisian National Cleaner Production Centre) focused on challenges and opportunities in promoting sustainable consumption in Africa. The concept of sustainability is not yet clear to people in Africa, where one of the major concerns is alleviating poverty. The driving forces in African countries are:

- economic and social development;
- export prospects;
- promotion of local consumption vs. importing of goods; and
- preservation of local customs.

Ms. Benzartim described the role of the NCPC as:

- awareness raising and promotion of sustainable consumption;
- building local capacity through training;
- fostering policy dialogue;
- facilitating the introduction of new tools and industries; and
- transferring eco-technology in a cost-effective manner.

She also gave an example of how using simple technology could reduce consumption of firewood in Tunisia. In that country 6.3 million m^3 of firewood is consumed per year, but only 2.8 million m^3 is produced. Households are the greatest consumers (4.5 million m^3). A special type of stove lid could reduce household firewood consumption by 50%, the equivalent of 150,000 tonnes of petroleum per year. This example illustrates that sustainable consumption can be achieved in an African context, provided strategies are characterized by:

- striving to meet the basic needs of all;
- building local capacity; and
- fostering constructive partnerships between stakeholders (government, industry and consumers).

Charles Laroche (Vice President, Corporate Relations and Public Affairs, Unilever HPCE, Belgium) talked about the Code of Good Environmental Practice of the International Association for Soap, Detergent, and Maintenance Products (AISE) and its "Wash Right Campaign". AISE represents national associations and their member companies in 28 countries, mainly in Europe. The campaign has successfully reduced consumption of energy, water and laundry detergent by 5-10%. AISE members have committed themselves to improve their environmental

Amel Benzartim

progress when formulating products and packaging for household laundry detergents, and to encourage consumers to be more closely involved in proper product use.

Mr. Laroche presented what AISE has learned in trying to connect with consumers on environmental issues. The major environmental impact of washing powders derives from consumer use and disposal, but the general public is largely unaware of the fact. Even if they were aware of it, most people would not sacrifice a consumer benefit to meet an ecological goal. Initiatives like the Wash Right Campaign offer an opportunity to be a satisfied consumer *and* a good citizen. Issues arising from efforts at sustainable advertising were identified:

- the role of detergent on the sustainability agenda;
- the logic of commerce vs. values of sustainability; and
- the logic of brand identification vs. a common strategy for sustainability.

Involvement of youth in promoting sustainable consumption was discussed by *Dania Quirola Suarez* (AIESEC Alumnus, Ecuador) and *Karen Koernig* (Manager Environmental Youth Alliance, UNEP, Youth Advisory Council, Canada). Ms. Suarez noted that UNEP benefits from the network of youth carrying out grassroots work on sustainability issues, including members of the International Association of Students in Economics and Business (AIESEC), which now accepts students from many disciplines. A network has evolved out of a national youth forum on Youth and Sustainable Consumption in Cameroon bringing together 500 groups.

Mr. Koernig described how youth in Canada are using video and other media to communicate sustainable consumption messages. For example, in cooperation with UNEP, two young women have produced a video on sustainable consumption. Other young people are putting together a magazine in French and English concerned with Cleaner Production and changing consumer behaviour. There are many instances of youth working in partnership with business on sustainability issues.

He pointed out that sustainable consumption challenges existing ideas of "cool" and desirable lifestyles. Many young people in Canada and elsewhere are working to change their peers' consumption patterns. Sustainable consumption patterns will create the demand needed for implementing Cleaner Production.

Panellists then responded to participant comments and questions:

- **"How do we jump-start the process of changing behaviour?"**

Mr. Laroche: An advertising code of conduct is needed, and UNEP is working to develop one. It has to be at the industry level, but involving marketers.

- **"The detergent example is a good initiative, but it makes it too easy on the consumer side. I'm personally sceptical how much consumer behaviour can ultimately be changed. I believe change will have come from offering sustainable services and products for the same or less money than other products."**

Mr. Koernig: I agree that changing behaviour is a challenge. The impact of culture is tremendous. Let's look at car sharing. For young people their first car is very, very important, but car sharing has the potential to shift perceptions a little bit, provided there is government support that fosters car sharing, use of public transport and so on. Yes, young people are more open to new ideas, but things can backfire if all sectors are not involved.

Charles Laroche

Parallel Session

Cleaner Production: The Untold Stories

This session provided a platform for discussing what has not been successful in Cleaner Production implementation and trying to understand why. It was chaired by *Don Huisingh* (IHEE, Lund University, Sweden) and facilitated by *Surya P. Chandak* (Cleaner Production Coordinator, UNEP DTIE). The rapporteur was *Sergio Mussmanni* (Director, NCPC, Costa Rica).

Barriers to the success of Cleaner Production identified in these discussions included:

- unexpected changes in government policy, e.g. in the definition of waste;
- unclear or unrealistically high expectations of a project;
- difficulties in obtaining underwriting;
- lack of management commitment;
- lack of clarity with respect to roles;
- lack of empowerment of employees at all levels; and
- cultural issues, internal as well as those of advisors coming in.

Threaded through all the stories presented were attitudinal, motivational and psychological dimensions. It was concluded that success depends as much on psychological and cultural factors as on technical and managerial ones.[1]

1. See page 72 and the CP6 web site (www.uneptie.org/CP6).

"Are there no government policies that help consumers to think about sustainable consumption?"

L. Suarez: Building consumer awareness of consumption impacts on the environment is important, as are market incentives to promote Cleaner production. However, if we don't cooperate across all countries, we will achieve nothing. For example, as noted earlier, the emission reduction benefits of new cars are undercut if heavily polluting old cars are exported.

Perspectives for the next decade

Participants presented a number of personal perspectives on the seminar and made recommendations that feed into the overall seminar recommendations. Below are some highlights of these personal perspectives.

John F. Jacovides (Senior Industry Development Officer, Industry Canada) said that "We have not got very far yet on the sustainable communities journey." He was pleased, however, to note the emphasis the seminar had placed on "out of the box" thinking and linking of Cleaner Production with the broader agenda of sustainable development – the evolution from cleaner to clean enough. He captured key themes from the meeting with two quotations:

"To survive, we need a new manner of thinking." – Albert Einstein

We need "actualization of a new lifestyle of permanence." – E.F. Schumacher

Ken Geiser commented that much had been achieved in the field of Cleaner Production and during the seminar. "We moved forward in this meeting," he said, "because we focused on evaluating and criticizing ourselves." Participants were asking themselves: "How can I contribute to get better results out of the work of furthering Cleaner Production?"

Appreciation of the attendance of His Excellency *Milos Kuzvart*, Minister of Environment, Czech Republic, was expressed by all. Minister Kuzvart thanked UNIDO and UNEP for Cleaner Production assistance to his country. The Czech Ministry of the Environment plays a catalytic role in fostering sustainability in the Czech Republic. He had the sense from the discussions of the past two days that this is the right role for it. To much applause, he invited UNEP to hold CP7 in Prague in 2002.

Jacqueline Aloisi de Larderel of UNEP and *James Rowden*, representing the Government of Canada, offered concluding remarks summarizing some of the ideas proposed during the seminar to meet current challenges to Cleaner Production. Thanking organizers and participants for the hard work that led up to CP6, and the work achieved during the seminar, they wished them good luck and success for the work that lies ahead.

Notes

To learn more about CP6 (and for the full text of presentations and background papers, as well as the web forum discussion previous to the seminar), go to *www.uneptie.org/CP6*. ◆

From Korea to Canada

Each biennial High-level Seminar on Cleaner Production highlights progress made in the previous two years. To introduce the Plenary Sessions and set the tone for CP6, Jacqueline Aloisi de Larderel, Director of the UNEP Division of Technology, Industry and Economics, reviewed the eight recommendations from the Fifth High-level Seminar in Seoul and the progress on each.

1. Develop a systematic approach for regional initiatives.
Since CP5, four regional Cleaner Production roundtables have been established – Asia-Pacific, Africa, Europe and Latin America.

2. Use influence with large companies to reach small and medium-sized enterprises through the supply chain.
Activities have been launched, including a calendar targeting SMEs. Through this and similar activities, UNEP is promoting a life-cycle approach.

3. Get involved with ISO Technical Committee 207.
UNEP supports ISO 14001 of the International Organiztion for Standardization as a tool to achieve Cleaner Production.

4. Use the advertising sector to advocate sustainable development.
An advertising initiative is under way for 2001. In January 1999, UNEP convened its first meeting on advertising. A second meeting was held in Paris in June 2000.

5. UNEP should support existing initiatives such as multilateral environmental agreements.
This is being done. UNEP works with existing conventions on the integration of Cleaner Production. Work has already been carried out with the Basel Convention. A Parallel Session at CP6 was devoted to exploring further ways to link efforts.

6. UNEP should set up an information sharing and exchange working group.
A working group has been established, and CP6 had a Parallel Session on information sharing and exchange.

7. Promote the Declaration as a tool to implement Cleaner Production.
The Declaration has been promoted through raising awareness and developing implementation tools. The tools developed include: implementation guidelines targeting signatory categories, a questionnaire sent to signatories, and a Declaration Support Group. Promoting the Declaration was a major theme of the seminar.

8. NCPCs and working groups should interact.
Due to lack of funding, it is difficult to ensure close interaction between working groups and NCPCs.

Accomplishments

Progress on Cleaner Production was also discussed in terms of tangible results. The following is a partial listing of accomplishments in 1998-2000.

National Cleaner Production Centres:
- UNIDO/UNEP centres total 19 (up from 15 in 1999)
- CP active institutions total 331 in 75 countries (up from 311)

Canada hosts First International Pollution Prevention Summit

"What can we do collectively that as practitioners we cannot do alone?" This is the question asked by *Marianne Lines*, Executive Director of the Canadian Centre for Pollution Prevention (C2P2), as she welcomed participants to the International Pollution Prevention Summit that followed UNEP's Sixth International High-level Seminar on Cleaner Production.

The Summit was hosted by the C2P2 and Environment Canada's National Office of Pollution Prevention, with guidance from an international Steering Committee of pollution prevention roundtables, CP networks and UNEP. There were more than 250 participants from over 60 countries.

Ray Anderson (CEO of Interface Inc.), the keynote speaker, said reading *The Ecology of Commerce*[1] inspired him to restructure his corporation according to seven sustainability principles:
1. eliminate waste;
2. avoid using or producing toxic substances;
3. aim for closed-loop recycling;
4. be energy-efficient and use renewable energy;
5. deliver products and transport people in a carbon-neutral way;
6. encourage the outside links of your process (e.g. suppliers, customers) to make choices based on sustainability;
7. re-invent commerce itself (e.g. provide a service rather than a product).

Mr. Anderson is convinced that setting an example demonstrates the benefits of pollution prevention. "It's not just the right thing to do, it's the smart thing to do. Businesses that don't move in this direction won't survive".

Action planning

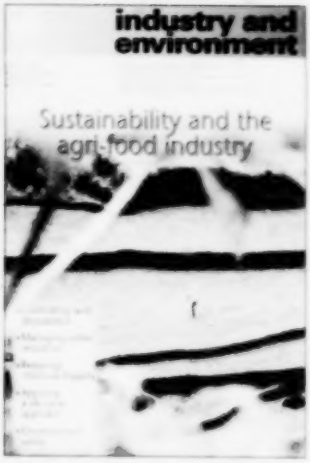
Action planning workshops identified roles and responsibilities for achieving actions and considered how they should be implemented and monitored.

Changing behaviour

Participants explored behaviour that fosters or impedes sustainability efforts and examined cultural influences. Some actions identified include:
- integrating sustainability concepts into media messages;
- nurturing charismatic leaders for effective delivery;
- developing a model environmentally preferable purchasing programme.

Finance

Prticipants identified priority areas where the environmental community can influence the financial sector to promote pollution prevention:
- improving financial and environmental performance measures;
- developing specific market instruments;
- promoting appropriate business planning tools.



Regional CP initiatives (UNEP-supported):

- Second CP Roundtable – the Mediterranean
- African Roundtable on CP and SC
- National CP Roundtable – Mexico
- Regional CP Roundtable – Latin America and the Caribbean
- Annual European CP Roundtable
- Annual Asia and Pacific CP Roundtable
- International Pollution Prevention Summit
- West Asian CP and SC Roundtable

UNEP's CP publications:

- *Industry and Environment* issues on:
  - Changing Consumption Patterns
  - Sustainability and the Agri-food Industry
  - Financial Services and Sustainability
  - Cleaner Production: Fifth International High-level Seminar, Seoul
- *Cleaner Production Assessment Guides*: meat, fish, dairy processing
- *Cleaner Production Newsletter*: Issues No. 15-17
- *Cleaner Production: A Guide to Sources of Information*
- *Towards a Global Use of Life Cycle Assessment*
- *CP in the Mediterranean: Second Regional Report*

Education

Participants agreed that educational materials should include both technical and non-technical dimensions of environmental problems and solutions. They proposed:

- updating the inventory of worldwide educational initiatives for on-line access;
- coordinating an integrated process concerning the need for further education and additional supporting material;
- making plans with a clear timeframe and monitoring programmes.

Policy

Strategic plans and tools for policy consisted of a compendium, a roundtable action strategy, and policy guidelines. Participants recommended an awards programme and increased product/process disclosure to support the design and implementation of strategic plans.

What's next?

Ongoing communication, action plan promotion, and locating resources were considered essential for achieving the action plan objectives. In addition to follow-up meetings at pollution prevention and CP roundtables worldwide in 2001, participants identified 30 key events where the outcomes should be promoted. The Government of Canada delegation will present the Summit results to the UN General Assembly during the ninth meeting of the UN Commission on Sustainable Development in 2001.

New Global Information Network

Roundtable leaders from around the world unveiled the Global Cleaner Production Information Network.[2] Regional nodes will be launched throughout 2001, providing each area with its own network to address regional interests.

Speakers at the Summit

James Riordan (National Office of Pollution Prevention, Environment Canada) chaired the panel on "The Power of Pollution Prevention Roundtables". *Olivia La O'Castillo* (Asia-Pacific Roundtable on Cleaner Production), *Leif Thuresson* (European Roundtable on Cleaner Production), *Ariel Gustavo Carbajal* (Roundtable of the Americas) and *Dave Johnson* (US National Pollution Prevention Roundtable) focused on how their roundtables are organized and roundtables' impact on governments and on advancing pollution prevention. The closing speaker, *Oscar Motomura* (founder of a management development centre for business executives in Brazil), urged participants to go beyond conventional problem-solving.

The role of pollution prevention in achieving sustainability

Chanpol Bunyagidj (Thailand Environment Institute) chaired a panel on "The Role of Pollution Prevention in Achieving Sustainability". Speakers addressed why pollution prevention is not automatically seen as fundamental to sustainability. *Ken Geiser* of the Toxics Use Reduction Institute cited several reasons:

- Sustainable development is about systems, while pollution prevention tends to focus on components, seldom generating a comprehensive perspective;
- Sustainable development is about equity, while pollution prevention remains silent about issues of poverty, social equality and human justice;
- Sustainable development is about consumption, while advocates of pollution prevention have championed the ideas of sustainable consumption, with limited practical advice.

Mr. Geiser argued that pollution prevention practitioners could learn from the current approach to sustainability by becoming more systemic, a

oriented and attentive to social factors.

Iancaio Altamo-Rivera of the UN Department of Economic and Social Affairs urged the audience to find ways to make changes in the way managers, investors and governments make daily decisions. The challenge is to find how pollution prevention can be of use to today's business and government cultures.

Expanding the influence of pollution prevention roundtables

The panel on "Expanding the Influence of Pollution Prevention Roundtables", chaired by *Barry Burnap* (Colorado Department of Public Health and Environment), outlined ways to increase participation in pollution prevention initiatives.

Ilze Kruzenshtern (Northern Alliance for Sustainability) reviewed challenges that NGOs face in working with governments and business on CP. In Europe, NGOs apply pressure for policy change rather than working with governments to effect improvements. Partnership with business is hampered by a "climate of mistrust".

Dave Bennett (Canadian Labour Congress) emphasized that pollution prevention and sustainability should go hand-in-hand with green job creation. *Carol Carmichael* (Institute for Sustainable Technology and Development) said universities must ensure that all graduates understand their role in sustainability and have the necessary tools.

Youth perspective

People under the age of 20 represent over 40% of the world's population and a large proportion of consumer demand. If CP and sustainable consumption engage only decision-makers from business and government, they will achieve only one-sided change. Thoughts from youth representatives presented at the Summit included:

- Pollution prevention should be both an individual and collective responsibility.
- If we want a better environment, we must not only find technological solutions but also modify our behavior and cultural values.

Notes

1. Paul Hawken (1993) *The Ecology of Commerce: A Declaration of Sustainability*. Harper Collins, New York.

2. See p. 68.

The Summit organizers thank all participants for their contributions. Summit follow-up is available at www.c2p2online.com

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Putting Cleaner Production into practice

For more information on Cleaner Production, consult UNEP's web site. Information concerning CP6 is available at *www.uneptie.org/CP6*.

The recent UNEP publication *Cleaner Production: A Guide to Sources of Information* is an invaluable reference tool. It includes contacts and descriptions of CP centres and organizations, as well as activities, publications, electronic information sources (e.g. databases and Internet sites), audio-visual materials, training resources and other Cleaner Production related information.

Participant perspectives

Over 250 high-level decision-makers from 75 countries participated in CP6. Some had attended previous High-level seminars while for others this was an introduction. Here are some comments by participants.

• Julia Ferriera, Manager, Pollution Prevention Section, CETESB, Brazil

A lot of CP work has been done in developing nations, which I would never have known about if I hadn't attended this meeting. Some of these experiences, including ones with not so positive results, have helped us in the planning and actual development of our work.

For the future, a direct marketing strategy should be developed to propagate CP concepts among small and medium industries, focused on real-life examples. To support these industries, a low-interest credit line should be created. Policies should be created and enforced to reach predetermined targets. CP will only bring good results if it is part of a broader environmental control programme.

Nehal Abeysekera

• Nehal Abeysekera, Vice-President, Federation of Chambers of Commerce and Industry, Sri Lanka

As a signatory to the CP Declaration and also the future host of a UNIDO/UNEP NCPC, CP has a bright future in Sri Lanka's business community. The NCPC aims to establish national capacity in Sri Lanka to ensure the concept's sustainable application to industry. The NCPC will serve a coordinating and catalytic role for CP by conducting in-plant demonstrations, organizing training programmes, promoting CP technology investment projects and providing policy advice to government, and by being a source of information on CP.

The NCPC's operations will be launched from a strong foundation of CP activity in Sri Lanka, supported in part by the organization FCCISL through its Project SMED, which has taken a lead role in promoting and popularizing CP among industries/business through audits, implementation, training and information dissemination. With the added support of UNIDO, UNEP and the Ministry of Industrial Development, CP is now on the national planning agenda. The National Action Plan of the Ministry of Environment and Forestry has taken CP as a strategy to minimize pollution rather than applying traditional end-of-pipe approaches.

CP has also been integrated into large-scale projects for development of industry sectors such as leather, as well as planning of industrial parks.

Encouraging private-public partnerships involving financial institutions is another area of FCCISL/SMED CP activities. Present CP activity has attracted other important projects such as the UNIDO Triple Bottom Line project and the Asian Development Bank's project to green the supply chain. Efforts have been extended to include CP at secondary and higher educational levels and to promote research. Areas that remain to be developed include life-cycle assessment, CP accounting and benchmarking.

• Margaret Chinamhora, Permanent Secretary, Ministry of Environment and Tourism, Zimbabwe

As a newly appointed Permanent Secretary for the Ministry of Environment and Tourism in the Republic of Zimbabwe, I was highly honoured and privileged to be a participant and chairperson in the Parallel Session on "National Centres: Delivering Cleaner Production."

As Zimbabwe is one of the few African countries (including Tanzania) that has established a National Cleaner Production Centre (NCPC), I was able to get invaluable information and ideas from the seminar and discussions with other participants. Experiences and proposals on financing NCPCs were of particular interest to me, as my country is looking at ways and means of self-financing.

The seminar was well organized with interesting topics. It was well attended at high level by both the public and private sectors and academic and other technical institutions, making it worthwhile to participate.

Margaret Chinamhora

Reflections on relations between the UNEP High-level Seminars on Cleaner Production and the regional roundtables

• Uno Abrahamsen, Project Manager, National Institute of Technology, Oslo, Norway

Since I was a participant at CP2 in Paris in 1992, there has been tremendous development which is hard to see on a year-to-year basis, but easy to understand from the important achievements over ten years.

One important element of the seminars is, and always has been, the networking potential for participants and possibilities to share experiences. For me, this was extremely important when I was responsible for setting up a Cleaner Production Programme in Norway.

CP6 has evolved, and there is now a stronger policy focus. How to do a CP assessment seems to be conventional wisdom, but how to develop a demand for the Cleaner Production strategy seems to remain a difficult task. The CP Declaration and the "financing" project are important steps in addressing this. Concerning the CP Declaration, I believe more could be done to monitor implementation progress. Signing the Declaration is easy, but implementing it is the challenge facing signatories, with UNEP's assistance.

Furthermore, there are a number of instruments to help develop a demand for CP. The problems of developing an effective mix – or an appropriate mix of sticks and carrots – remains to be solved.

At CP 4, a proposal developed by OECD and presented at CP5 was used for benchmarking CP promotion in Asia. I believe this benchmarking tool is useful. It could be used by UNEP to monitor the progress of CP implementation in different regions.

One issue to be considered in upcoming seminars is how best to enable the regional events to handle relevant regional issues, and how best to let the global events handle global issues. Mixing agendas could lead to a dilution of efficacy in addressing needs.

• Marianne Lines, Director, Canadian Centre for Pollution Prevention, Canada

In October 2000, decision-makers and leading practitioners from around the world gathered in Canada to strengthen partnerships and stimulate further action on Cleaner Production and pollution prevention.

The outcomes of CP6 and the International Pollution Prevention Summit underline the cross-cutting nature of cleaner production/pollution prevention initiatives. Pollution prevention is a fundamental component of sustainability. Its basic tenet, preventing pollution from occurring, offers the promise of integrated and balanced social, economic and ecological benefits for individuals and at the local, national, regional and international levels.

There were concrete results. The International Pollution Prevention Summit resulted in the launch of a Global Information Network – a permanent network that goes beyond annual meetings, to truly link practitioners and encourage ideas and innovation. Designed to become a vital tool resource for businesses and governments, the Internet-based network will connect and serve as a virtual meeting place for pollution prevention roundtables, sustainability and Cleaner Production networks and other organizations worldwide that are committed to advancing Cleaner Production and pollution prevention.

Marie Tamoifo Nkom

Karun Koernig

• Marie Tamoifo Nkom, President, Association Verde du Cameroun, UNEP Associate Youth Advisor, and Karun Koernig, Manager, Environmental Youth Alliance, UNEP Youth Advisor for Canada

Youth are an important stakeholder group. Young people below 20 years of age make up over 40% of the world population. They will also inherit 100% of the world's problems. Efforts should be made now to start using our planet's limited resources more wisely. Why not ask adults to use their share of the natural resources and to pay their share of all necessary environmental clean-up? The young people of today should not be forced to have a lower quality of life and be stuck with major clean-up bills.

Some recommendations include:

- Work with youth to continue defining more concretely what sustainable consumption means to them, and disseminate the results widely.
- Continue to include youth in international fora, and provide them with support in pre- and post-conference discussions, surveys and dissemination.
- Work with a committee of youth to try to encourage entertainers and other youth opinion makers to learn about sustainable consumption. ◆

Cleaner Production perspectives 1: CP and industrial development

René Van Berkel, CSBP Professor of Cleaner Production and Director, Centre of Excellence in Cleaner Production, Curtin University of Technology, GPO Box U 1987 Perth WA 6845, Australia (r.vanberkel@curtin.edu.au)

Summary

Is the way Cleaner Production is defined still appropriate? Do the key underlying assumptions for promoting CP still have currency in today's industrial world? How can CP programmes be modified to improve their effectiveness and enable a quantum leap in uptake during the next decade? Such questions are addressed in this article. Suggestions are also made concerning improvements to current Cleaner Production practices.

Résumé

La définition actuelle de la production plus propre est-elle adaptée à la réalité ? Les hypothèses qui sous-tendent les initiatives pour promouvoir la production plus propre ont-elles encore cours dans le monde industriel d'aujourd'hui ? Comment modifier les programmes pour produire plus propre pour les rendre plus efficaces et permettre un bond prodigieux en avant dans les dix années à venir ? Telles sont les questions abordées par cet article qui fait également des suggestions pour améliorer les pratiques actuelles en matière de production plus propre.

Resumen

¿La definición de producción mas limpia continua siendo apropiada? ¿Las razones claves subyacentes para promover la Producción más Limpia siguen vigentes en el mundo industrial de hoy? ¿De qué manera se pueden modificar los programas de Producción más Limpia para aumentar su efectividad y permitir la generación de un salto cuántico en la próxima década? El articulo responde a estos interrogantes. Se presentan también sugerencias respecto a mejoras en las practicas actuales de Producción más Limpia.

This article is about trends in the promotion and uptake of Cleaner Production around the globe, and improvements that could be made to better serve the environmental and sustainable development agendas. As a starting point, one could look at current progress from two different perspectives – Cleaner Production and industrial development.

Cleaner production started as an integrative and preventive environmental management strategy for avoiding, or at least minimizing, environmental impacts from industrial products and services, as well as from the production, distribution and service processes they require. The field has matured over the last 25 years. During the last decade, in particular, there has been remarkable progress putting Cleaner Production on the agenda of industry, government and communities in both industrialized and industrializing countries. Cleaner production programmes have generally been successful in demonstrating potential environmental, financial and other benefits of an integrated, preventive environmental management strategy for industrial operations.

Despite the ever-increasing set of positive industry case studies (covering an expanding range of countries, sectors, products and market niches), Cleaner Production activity still appears to be limited. Surveys show that the number of companies considering Cleaner Production is steadily increasing, and that a growing number of industries have even implemented selected options that could be regarded as Cleaner Production. However, it is felt that Cleaner Production's potential has not yet been fully utilized, as implementation of the first Cleaner Production options has not been further substantiated and sustained through systematic integration of Cleaner Production principles in key functional areas of business operations (e.g. production management, accounting and reporting, and process and product development).

In today's world, we see that Cleaner Production outcomes are being achieved without specific consideration of Cleaner Production principles, especially in areas and sectors with comparatively high growth. Businesses expand and replace production capacity. As previously used equipment and technology is no longer available, the expansion and renovation of businesses results in the installation of newer technology that is most often at least incrementally more efficient. The new or renovated facilities will be able to produce with less materials, energy and water, while generating less waste and emissions, and thus realize Cleaner Production outcomes.

If some Cleaner Production outcomes are achieved without specific consideration of the underlying Cleaner Production principles, while Cleaner Production programmes have only limited success in enabling structural change in companies, it is time for a strategic retreat. Is the way Cleaner Production is defined still appropriate, and do the key underlying assumptions for its promotion still have currency in today's industrial world? How can Cleaner Production programmes be modified to improve their effectiveness and enable a quantum leap in the uptake of Cleaner Production within the next decade? I will address these questions in this article, in order to encourage and stimulate discussion, and present some initial thoughts on how current Cleaner Production practice can be improved.

Review of status

The launch of 3M's Pollution Prevention Pays programme in 1974 is generally regarded as the first landmark on the road towards Cleaner Production. The 3P programme was unique in its recognition of the importance of process and product innovation for achieving the dual objectives of enhancing competitiveness and reducing environmental impacts. The continued success of the 3P programme has been widely acknowledged. It clearly demonstrates that pollution prevention or Cleaner Production opportunities will continue to emerge if proper incentives are given employees and engineering staff, and if environmental objectives are integrated in process and product innovation.

However, pollution prevention was practised long before the 3P programme came into being, although it was not known as pollution prevention or Cleaner Production. The American Petroleum Institute, for instance, reviewed solid waste management practices for storage tank bottoms, refinery sludges and production waste waters between 1950 and 1985.[1] It was found that 32% of the standard industrial practices for these waste streams would, under current definitions, be regarded as source reduction, 41% as recycling and reuse, 18% as treatment and only 9% as disposal.

Programmes like 3P inspired other industries to explore pollution prevention opportunities, initially mainly among the large processing and manufacturing industries in North America, but later more widely across a broad set of industry sectors as well as among small and medium enterprises. The concept was also transferred to, and subsequently further developed in, other regions (e.g. Europe and Australasia, followed by Asia, Latin America and Africa) thanks to the catalytic role of UNEP's Cleaner Production Programme and the

partners in its evolving global Cleaner Production network.

Many Cleaner Production initiatives and programmes have gone through a number of stages, regardless of whether these were focused on a country, region or industry sector. These programmes initially meet a considerable degree of resistance, particularly from industry, most often until at least a few local Cleaner Production successes have been developed. Next programmes can go into a period of rapid development, with growing recognition of the potential benefits of Cleaner Production by industry and government, and implementation of Cleaner Production technologies and practices in industry. After this rapid development, a consolidation stage could be reached.

Industry and government generally endorse Cleaner Production. Practical Cleaner Production outcomes with environmental and financial benefits are being achieved, although in many cases they are the result of industry modernization rather than environmental considerations. Many programmes, however, experience a drawback in the consolidation stage or even before this stage commences. Stakeholders start to recognize that whether "pollution prevention pays" depends on the level of environmental legislation and its enforcement, material and energy costs, and the costs of managing and disposing of waste and pollutants. Moreover, it generally turns out that the Cleaner Production outcomes (i.e. the options implemented in industry) could also have resulted from other efforts (such as total quality management, process and product innovation, and other efficiency drives). The outcomes are thus not unique to Cleaner Production.

Cleaner production experience and expertise are still largely concentrated in the manufacturing and processing industries. We reviewed the present application of Cleaner Production to industrial development trends – from a European perspective – and found an apparent paradox. Although Cleaner Production is based on a preventive mindset, current Cleaner Production efforts are often still made in the final phases of industrial development rather than being designed in right from the start. In other words, Cleaner Production has moved industrial environmental management from the end of the production pipe to the end of the innovation pipe, but has not yet been integrated into the innovation cycle as required for the transition towards *a priori* clean products and processes.[2]

How Cleaner Production is defined

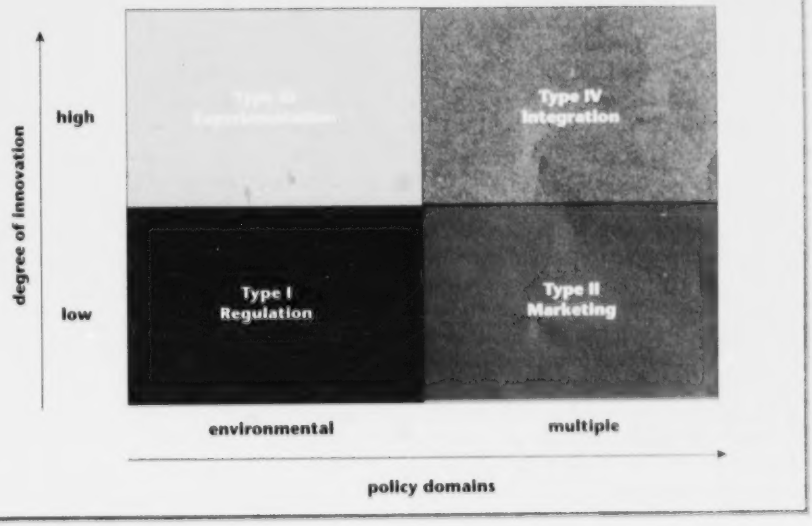
By the end of the 1980s, a great many competing concepts and definitions had been developed and used to focus attention on the opportunities and benefits of a preventive approach to industrial waste management and environmental issues: e.g. waste minimization, waste prevention, source reduction, pollution prevention, clean technology, cleaner technology, toxics use reduction, etc.[3] Against this background, UNEP has been successful in proposing Cleaner Production as an overarching concept, and in building consensus on its operational definition.

Table 1
Breakdown of UNEP Cleaner Production definition

Process elements	Applications	*Outcome* elements
Continuous application of an integrated preventive environmental strategy		
	to products, processes and services	
		to increase eco-efficiency and reduce risks for humans and the environment
	For production processes, Cleaner Production involves	
		conserving raw materials and energy, eliminating toxic raw materials, reducing the quantity and toxicity of all emissions and wastes before they leave the process
	For products, Cleaner Production involves	
		reducing negative impacts along the life cycle of a product, from raw materials extraction to its ultimate disposal
	For services, Cleaner Production involves	
		incorporating environmental concerns into designing and delivering services
Cleaner Production requires changing attitudes, applying know-how and improving technology.		

The UNEP definition contains process and outcome elements, with the latter being elaborated for each of the three main application areas for Cleaner Production: processes, products and services (Table 1). This combination of process and outcome elements has both advantages and disadvantages. The key advantage is the link between a short-term interpretation (that Cleaner Production is about preventing pollution and increasing resource efficiencies) and a long-term interpretation (that Cleaner Production envisions the integration of the environmental agenda into key business functions). It is generally perceived that although the short-term interpretation is critical for getting started with Cleaner Production, the long-term interpretation is conditional for achieving comparatively radical environmental innovations in products and processes that, in principle, have the greatest potential for cost-effective factor improvements in the resource efficiency of products and processes. The disadvantage of the link between Cleaner Production process and outcome elements is that the latter are fairly generic and can be achieved without the Cleaner Production process (e.g. as a result of expansion or renovation of production facilities, or regular product design efforts not driven or shaped by environmental

Figure 1
Typology for Cleaner Production programmes



considerations). One might conclude that the Cleaner Production process is more than, or perhaps even entirely different from, the sum of the Cleaner Production outcomes.

The generic nature of Cleaner Production outcomes runs the risk of creating a deadlock for the promotion of Cleaner Production.[4] It enables the initial marketing, since Cleaner Production has become a non-threatening strategy that is in the business's self-interest and can be achieved through incremental changes. Meanwhile, such incremental changes already occur as a result of regular efficiency drives and process and product innovation. The incremental nature of the Cleaner Production outcomes thus becomes a barrier to achieving progress on the long-term process goal of integrating Cleaner Production considerations into key business functions. In other words, it becomes increasingly hard to convince businesses to change the way they do business to favour "even more cleaner" production, as it becomes clear to them that they are already achieving Cleaner Production outcomes through their regular business operations. And such changes in business processes are indeed needed to achieve the long-term potential of Cleaner Production.

Another related criticism often heard is: "Cleaner is good, but may not be clean enough." In the case of a highly polluting company, it may be fairly easy to become cleaner through implementing simple operational changes, although even after these changes the company's environmental performance could still lag behind average industry practice in the sector. This could even remain the case after investment in new equipment. Consider, for instance, a dry cleaner currently operating a so-called "third generation" perchloroethylene dry cleaning machine that invests in a new "fourth generation" machine. It is obvious that the company becomes cleaner, as the amount of garments cleaned per litre of solvent used almost doubles, and consequently the solvent emissions per garment cleaned are approximately halved. However, several "even more cleaner" technologies have been proven and are readily available, such as the use of alternative, less toxic solvents, more efficient use of perchloroethylene (fifth generation dry cleaning equipment) or multi-stage washing with water.[5] The dry cleaner thus adopts a Cleaner Production option that lags behind the industry's environmental best practice. Would that still qualify as Cleaner Production?

The answer depends on what we want to achieve. If we aim for widespread uptake of Cleaner Production, the answer should be yes. Polluting businesses get an early reward for moving towards industry environmental best practice, anticipating that this will encourage them to take further steps in the near future that will eventually bring those businesses to the environmental best practice level. As a consequence, businesses operating at or close to industry environmental best practice have a much harder time achieving Cleaner Production and may not incorporate the task of integrating Cleaner Production principles into their key business functions. If, on the other hand, we aim to encourage the "good" performers to improve on their industry's environmental best practice, any options that will not achieve it should not be considered as Cleaner Production. Consequently, Cleaner Production becomes more of an "elite" approach for the best performers. It provides an incentive for those best performers to improve further. It can be expected that, sooner rather than later, the poorer performers in the sector will have to match the best performers in order to remain competitive and or conform to environmental regulations.

To focus attention on the process nature of Cleaner Production, and therefore call upon companies to incorporate Cleaner Production principles and practices into their core business functions and operations, it would be beneficial to distinguish Cleaner Production from environmental benefits achieved as a spin-off from non-environmental initiatives such as renovation, modernization and expansion projects. The outcome statements in the Cleaner Production definition would therefore have to be supplemented or even replaced with a performance statement. At least three types of benchmarks can be used for such performance statements. First, performance could be described in relation to environmental industry best practice (e.g. "Cleaner Production will at least achieve industry environmental best practice"). Second, performance could be described with reference to the Earth's carrying capacity (e.g. "Cleaner Production will result in progressive reductions of the environmental impact and resource consumption of products, services and processes to a level at least in line with the Earth's estimated carrying capacity").[6] The third alternative would be to link performance to environmental progress achieved by a company in reducing its environmental impacts or increasing eco-efficiency (e.g. "Cleaner Production is reflected in progressive improvements of the key eco-efficiency indicators that at least equal x% over y years").

Potential links with industry environmental best practice and the estimated carrying capacity of the Earth are probably the most meaningful, but they are also the most complicated to establish and update. Most likely these will evoke an ongoing debate concerning what the reference levels are for this industry environmental best practice or the Earth's carrying capacity. Performance in terms of progressive and sustained eco-efficiency improvements is therefore potentially a good compromise. It can build upon evolving work on eco-efficiency metrics[7] and provides a means of linking with factor 4, 10 or x efforts (sustained improvements in eco-efficiency of, for instance, 20% per three-year period would achieve, say, a factor 4 improvement over 20 years).

How Cleaner Production is being promoted

Over the last 15 years a great variety of programmes have been launched to facilitate the uptake of Cleaner Production in industry. Many programmes have had, and continue to have, a strong technical assistance component that assists businesses with the identification, evaluation and implementation of Cleaner Production options appropriate for their operations (through on-site auditing, training, information clearinghouses, etc.). Moreover, enabling policy frameworks have been set up, for instance on the basis of mandatory planning, voluntary agreements, industry environmental management codes or financial incentives. Only recently have the first efforts been taken for comparative assessment of the effectiveness of different policy regimes on uptake of Cleaner Production (particularly at the micro level, within and between industry sectors).[8] Strategic guidance for developing effective Cleaner Production programmes is therefore scarce and context bound if it exists at all. Against the strategic background of provoking more structural change to drive the uptake of Cleaner Production beyond obtaining the "low-hanging fruit", an initial classification of Cleaner Production programmes on two dimensions might be considered. These dimensions are:

- degree of innovation (whether or not the Cleaner Production programme contains innovative elements, in terms of technologies being assessed and pilot-tested, or in terms of establishing new partnerships between stakeholders, or using novel assessment methodologies and policy instruments); and
- involvement of different policy domains (whether the Cleaner Production programme is designed and managed strictly within the environmental policy domain, or with equal involvement from other policy domains, such as business development, technology and innovation, trade and investment, etc.).

If each dimension is divided into two categories, a typology for Cleaner Production programmes emerges: Regulation (Type I), Marketing (Type II), Experimentation (Type III) and Integration (Type IV) (**Figure 1**). A summary of the features of each of these types is presented in **Table 2**.

There are examples of successful programmes, at least in the case of the first three types:

Type I (Regulation)

Several states in the US (e.g. Massachusetts and Minnesota) have adopted legislation requiring businesses to develop and submit toxic use reduction or pollution prevention plans. The effectiveness of such legislation is generally perceived to be high, particularly in combination with a technical assistance programme that assists businesses with the development and implementation of their plans.

Type II (Marketing)

Interesting examples in this category include the UK Environmental Technology Best Practice Programme and the Australian Cleaner Production and Eco-Efficiency Programme. Both programmes rely heavily on provision of information to businesses by means of case studies and sector-specific environmental best practice guides.

In Australia, two recent surveys confirmed that the marketing approach has achieved a high level of awareness of Cleaner Production. However, it is

far less evident that higher awareness has resulted in the uptake of Cleaner Production beyond the "low-hanging fruit".[9] The first survey involved a cross-section of industries in New South Wales, Victoria and Queensland. There was a 16% response rate (153 companies responded). In the past, 85% of respondents claimed to have implemented waste minimization, 45% Cleaner Production and 5% eco-efficiency measures. Few respondents explicitly merged productivity and environmental issues – the core of Cleaner Production and eco-efficiency – as only a few reported that environmental management issues had a significant influence on their production strategies. The adoption of preventive environmental management practices was found to lag behind the general advance of the environmental management function. Companies are increasingly looking at moving beyond compliance, but not necessarily through preventive environmental management strategies such as Cleaner Production and eco-efficiency.

The second survey included interviews with 53 companies from across Australia which were recognized as industry thought leaders on environmental management. The results showed that 85% were aware of Cleaner Production. They also indicated that those companies that had employed Cleaner Production methods had not moved from using them on one project or problem to comprehensive use in all operations.

Table 2
Cleaner Production programme features

	Type I: Regulation	Type II: Marketing	Type III: Experimentation	Type IV: Integration
Underlying assumption	Without regulatory incentives, few companies will consider implementation of CP options.	If companies are better aware of CP options, they will implement CP, especially since the market will force businesses to implement CP to remain competitive.	Uptake of CP above present level calls for new CP solutions that are best developed through collaboration between stakeholders.	Uptake of CP above present level calls for concerted action by stakeholders to develop new CP solutions and achieve their widespread adoption.
Key CP policy instruments	Mandatory CP implementation (e.g. by means of CP planning process, EIA)	• Dissemination of case studies • Information clearinghouses • Industry training (incl. CP clubs)	• Demonstration projects • Voluntary agreements and covenants • Environmental levies • Carbon tax • Extended Producer Responsibility • Industry recognition programmes	• Long-term environmental standards • Benchmarking and eco-labelling • Green procurement programmes • Subsidies for environmental R&D and investment
Strength	Wide adoption of CP, driven by enforcement strategies	Focus on business opportunities provided by CP	Ability to develop new ("breakthrough") CP solutions	Long-term focus and integration of environmental issues in industry and technology policies
Weakness	CP application limited to regulated premises or substances	CP implementation limited to CP options provided	Most attractive to eco-innovators	Specific focus on CP may be lost

Type III (Experimentation)

The Netherlands presents a good example of this type, particularly for the timeframe roughly between 1988 and 1996.[10] In this period the first State of Environment and National Environmental Policy Plan were drafted, and covenants were set up for the management and reduction of priority waste streams. Several Cleaner Production demonstration projects were conducted, with different geographical focus and industry sector coverage. The 1993 amendments to the framework environmental law provided the opportunity to mandate a Cleaner Production plan as part of the permitting procedure. Moreover, exploratory projects were launched for perspectives of sustainable technology development, applicability of Cleaner Production in service and retail sectors, development of customized tools for Cleaner Production, and eco-design.

Type IV (Integration)

In general terms, it appears most likely that Type IV Cleaner Production programmes ("Integration") will be the most effective. This relates to both the number of organizations that consider and implement Cleaner Production, and the level of Cleaner Production achievements by each of these organizations (implementation beyond the low-hanging fruit options and inclusion of Cleaner Production considerations in key business functions). There are two key challenges for the transition to such Type IV programmes:

- to enhance the level of innovation in the design and implementation of Cleaner Production programmes.

Innovation is required in order to enlarge the array of available Cleaner Production solutions for consideration by industry and other stakeholders. Innovation can be strengthened through the establishment of new partnerships between stakeholders (e.g. manufacturers, consumers, R&D organizations, governments, financial sector), the application of novel strategies and instruments, and support for the development and evaluation of new Cleaner Production technologies and practices.

- to broaden and deepen the involvement of non-environmental governmental and non-governmental stakeholders in the design, implementation and management of Cleaner Production programmes.

The challenge ahead is to make sure that Cleaner Production is integrated into the process and product development processes right from the start. This will only be possible if businesses start to see that applying Cleaner Production principles will lead to greener and more competitive products. The message on competitiveness requires support from non-environmental agencies to be taken seriously by industry and other stakeholders.

The future: refreshing the vision and the practice

The future for Cleaner Production depends on how CP's present status is viewed. It is increasingly evident that Cleaner Production outcomes are being achieved without specific consideration of the underlying principles, and at the same time that CP programmes are only moderately successful in provoking structural change in companies. It has been argued that this situation is (or is about to become) a major limitation for achieving the long-term goal of Cleaner Production, i.e. progressive and ongoing reductions of the environmental impacts of industrial products, services and processes. Such progressive and ongoing eco-efficiency improvements are in turn a condition for addressing the evolving environmental and sustainable development agendas.

This article has proposed one way ahead, commencing with a fresh look at what should be realistically considered as Cleaner Production. A narrowing down of the Cleaner Production strategy appears to be inevitable in order to refresh the vision and focus Cleaner Production efforts more towards achieving longer-term and process-oriented objectives. This can be achieved with performance-based interpretation of Cleaner Production, and with performance linked to industry environmental best practice, the Earth's carrying capacity, or a designated rate of progress in reducing environmental impacts. The latter is probably the least desirable conceptually, but the most practical. Current Cleaner Production programmes would have to be revisited accordingly, to reflect the shift towards a performance-based interpretation of Cleaner Production.

In general terms, there appear to be two major challenges with respect to improving Cleaner Production programmes and policies: 1) enhancing the innovativeness of Cleaner Production programmes in terms of technologies considered, as well as methodologies and instruments used and partnerships established; and 2) broadening and deepening the involvement of non-environmental governmental and non-governmental stakehold-

ers in the design, implementation and management of Cleaner Production programmes.

Notes

1. Perkins, J. (1997) An Examination of Incentives and Obstacles for Pollution Prevention in the Petroleum Industry, Research Paper No. 87, American Petroleum Institute, Washington, D.C.
2. Van Berkel, R., E. Willems and M. Lafleur (1997) The Relationship between Cleaner Production and Industrial Ecology, *Journal of Industrial Ecology*, Vol. 1, No. 1, pp. 51-66.
3. A useful compilation of concepts and comparison of their content can be found in J. Van Weenen, *Waste Prevention: Theory and practice*, PhD Dissertation, Delft University of Technology, The Netherlands, 1990.
4. There is growing evidence that this deadlock is already occurring, e.g. in the United States (J. Hirschhorn, Why the Pollution Prevention Revolution Failed and Why it Ultimately Will Succeed, *Pollution Prevention Review*, winter 1997, pp. 11-31) and The Netherlands (T. De Bruijn and P. Hofman, Pollution prevention and Industrial Transformation: evoking structural changes within companies, *Journal of Cleaner Production*, Vol. 8, pp. 215-223; H. Dieleman, *The Cleaner Production Arena: Man and organization between preservation and innovation* (in Dutch), PhD Thesis, Erasmus University, Rotterdam, 1999).
5. For information on dry cleaning technologies and their alternatives, see, for example: *Cleaner Technologies Substitutes Assessment for Professional Fabricare Processes*, United States Environmental Protection Agency, EPA 744-B-98-001, Washington, D.C., 1998.
6. This approach has already been taken by the WBCSD in its definition of eco-efficiency (see, for example, *Eco-Efficient Leadership for Improved Economic and Environmental Performance*, World Business Council for Sustainable Development, Geneva, Switzerland, 1995).
7. Verfaillie, H. and R. Bidwell (2000) *Measuring Eco-Efficiency: A guide to reporting company performance*, World Business Council for Sustainable Development, Geneva, Switzerland.
8. See, for example, A. Clayton, G. Spinardi and R. Williams, *Policies for Cleaner Technology: A new agenda for government and industry*, Earthscan Publications, London, 1999.
9. Van Berkel, R. (2000) Cleaner Production in Australia: Revolutionary strategy or incremental tool? *Australian Journal of Environmental Management*, September, pp. 9-24.
10. See, for example, R. Van Berkel, *Cleaner Production in Practice*, University of Amsterdam, The Netherlands, 1996; L. Rowledge, et al. *Mapping the Journey*, Greenleaf Publishers, Sheffield, UK, 1999; G. Keijzers, The Evolution of Dutch Environmental Policy: The changing ecological arena from 1970-2000 and beyond, *Journal of Cleaner Production*, Vol. 8 (2000), pp. 179-200; P. Weaver, et al. *Sustainable Technology Development*, Greenleaf Publishers, Sheffield, UK, 2000.

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Cleaner Production perspectives 2: integrating CP into sustainability strategies

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Summary
Cleaner production has impacts as a set of tools, a programme and a way of thinking. These impacts can be assessed at various levels. Despite progress made during the past decade, CP issues that still need to be addressed involve government policy, environmental technology, waste reduction, workplace safety, economic development and social consumption. Three environmental objectives on which progress is needed in the next decade are detoxification, dematerialization and decarbonization. Some longer-range goals for Cleaner Production are also presented.

Résumé
La production plus propre a plusieurs impacts : en tant qu'ensemble d'outils, en tant que programme et en tant que manière de penser. Ces impacts peuvent être évalués à différents niveaux. Or, malgré les progrès accomplis ces dix dernières années, un certain nombre de questions n'ont pas encore été abordées dans ce domaine, notamment la politique gouvernementale, les technologies de l'environnement, la réduction du volume des déchets, la sécurité sur le lieu de travail, le développement économique et la consommation des collectivités. Les trois objectifs en vue desquels des progrès sont nécessaires dans les dix années à venir sont la détoxication, la dématérialisation et la décarburation. L'article présente également quelques buts à plus long terme de la production plus propre.

Resumen
La Producción más Limpia se presenta como un conjunto de instrumentos, un programa y un modo de pensar. Los impactos que generan se pueden evaluar a distintos niveles. A pesar del progreso de las últimas décadas, los temas pendientes en materia de Producción más Limpia incluyen políticas gubernamentales, tecnología ambiental, reducción de deshechos, seguridad en lugares de trabajo, desarrollo económico y consumo social. Tres objetivos ambientales a desarrollar en los próximos diez años son desintoxicación esmaterialización y descarbonatación. Se presentan también metas a más largo plazo para una Producción más Limpia.

From its inception, Cleaner Production has been about assisting companies and governments to develop more environmentally sound systems of production. That work will continue to be needed in the next decade, but with new directions and broader contexts.

The initial concepts of Cleaner Production were brought together during the mid-1980s. The establishment of UNEP's Cleaner Production Programme in 1989 provides a commonly recognized date for the formal launch of the concept. The UNEP Cleaner Production activities have generated national government programmes, national technical assistance centres, academic research and teaching programmes, non-governmental advocacy programmes, and a host of manuals, books and journals focused on Cleaner Production. Cleaner production initiatives have also supported or spawned a collection of new tools including facility assessments, full-cost accounting, technology assessments, eco-balances and life-cycle assessments. There have been international conferences, national roundtables, and an international declaration on Cleaner Production.

Cleaner production has had significant impacts as a set of tools, as a programme, and as a way of thinking. These impacts can be assessed at various levels:

- Cleaner production has been a *technology promoter*. At the simplest level, Cleaner Production programmes have advanced more resource-intensive and less hazardous production technologies. Aqueous cleaning, powder coatings, solvent recycling, non-cyanide plating, counter-current rinsing, lead-free soldering, water-based paints, vegetable-based dyes and bead-blasting strippers are physical ramifications of Cleaner Production initiatives.
- Cleaner production has been a *managerial catalyst*. It has liberated environmental values from the dungeon of residual management and regulatory compliance, placing them nearer the centre of product and process design. Environmental performance is increasingly considered an important management system that needs to be optimized, along with management systems, for quality and financial return.
- Cleaner production has been a *paradigm reformer*. The conventional economic view of environmental protection identified pollution control investments as a business cost. By promoting full cost accounting and green marketing, Cleaner Production has restructured environmental economics, converting environmental protection investments into productivity benefits. It has been proven that environmental values add to, rather than subtracting from, economic performance.
- Cleaner production has been a *conceptual bridge connecting industrialization and sustainability*. Since the work of the Brundtland Commission and the subsequent 1992 UN Conference on Environment and Development, the concept of sustainability has been enshrined as the global vision of a healthy future. Cleaner production has allowed industrial production to find a place in this vision by recasting negative images of polluting industrial processes into positive images of technologies that are materials-conserving, energy-efficient, non-polluting and low-waste, and that produce ecologically friendly products which are responsibly managed throughout their life-cycle.

Not satisfied with cleaning up production processes, Cleaner Production programmes have also addressed the products of production and the problems of consumption. These efforts, more recent and still emerging, have resulted in new approaches to product management including eco-design, integrated product chains, life-cycle assessments and Extended Producer Responsibility initiatives. Adding environmental values to product design, marketing and management, like adding them to process management, offers new opportunities to improve business performance and competitive advantage.

Current challenges for Cleaner Production

For all that has been accomplished under the banner of Cleaner Production, much remains to be done. Progress over the past decade or so has focused on many of the easier aspects and riper opportunities. Now the necessary changes are more complex and more costly. Progress on Cleaner Production has slowed, particularly in the more industrialized countries. Current Cleaner Production programmes have run up against several significant challenges involving:

- government policies;
- environmental technology;
- waste reduction;
- performance measurement;

- workplace safety;
- economic development; and
- social consumption.

Government policies

Cleaner production emerged after many industrialized countries had established environmental regulatory infrastructure. These legal structures, and the professionals trained and hired by government agencies and by regulated industries, have developed a sophisticated regulation and compliance culture. Discharge permits, and the government staff overseeing environmental compliance and enforcement, focus on what passes between the facility boundaries and the public environment. But Cleaner Production is about what goes on inside the facility, between facilities, and between facilities and their customers. Conventional regulatory legal structures and the cultures they support too often reduce opportunities for waste exchange, materials recycling and Cleaner Production solutions.

National Cleaner Production Centres have obtained mixed results in their attempts to address the policy issues that inhibit Cleaner Production, particularly where these centres are viewed as existing outside the conventional regulatory agency structure. Even if concerted efforts have been made to encourage environmental agency staff to adopt Cleaner Production approaches, they have proven quite resistant to change (Berlin Blackman and Luskin, 2000).

Environmental technology

Market and technical barriers tend to inhibit the diffusion of Cleaner Production technologies. The pollution control technology market remains substantially larger and more vital than that for Cleaner Production technology. Suppliers of waste treatment, pollution abatement and refuse disposal technologies are well established, with strong market recognition. Selling pollution control equipment generates profits, increases employment, and adds to gross national product figures. Cleaner production is often touted as a way to reduce operating costs, but promoters are generally silent on issues of increased sales, profits or jobs.

Many technologies for enhancing Cleaner Production are available. However, unlike the "add-on" equipment used to control pollution, CP technologies are often more central to the core processes of product production. Technical traditions, investments in older equipment, conventional work practices and skills, low motivation for change, and uneasiness with less conventional and less well tested technologies all inhibit transition to cleaner technologies in the core production processes. Indeed, Cleaner Production is often more than technology focused, involving changes in management practices and in the organization of product consumption and waste management systems, which are slow to change.

Heavy financial investments and managerial commitments in traditional manufacturing facilities reduce opportunities for low-cost solutions. New solutions are often best determined by original equipment manufacturers, chemical suppliers and large-scale customers who specify production procedures in long-term contracts. Recent developments in "green chemistry" and "sustainable materials" offer good opportunities for new feedstock materials, catalysts, routes of synthesis, and biodegradable and renewable materials, but many of these are still experimental (DeVito and Garrett, 1996; Anastas and Warner, 1998). Cleaner production advocates need to pay special attention to the "upstream" suppliers of production equipment and feedstock materials if "downstream" production facilities are to have the range of technological choices that make environmentally sensitive production technologies better investments than waste treatment technologies.

Waste reduction

On a global scale, the volume of domestic and hazardous waste is enormous. Just 28 parties to the Basel Convention reported that an aggregate total of 182 million metric tonnes of hazardous and special wastes was generated in 1997 (UNEP, 1999). In the United States, industries generate some 41 million tonnes of hazardous wastes per year. The municipal solid waste stream grew from 87 million tonnes in 1960 to 209 million tonnes in 1996 (US EPA, 1998; 1999). The scale of waste generation threatens the natural assimilative capacities of many of the planet's regional ecosystems. The symptoms of global change provide suggestive warnings of the costs of such vast amounts of waste chemical releases and movements of materials.

The industrial threat to public health and the environment is caused by thousands of production and extraction activities throughout the world. Hundreds of good case studies demonstrate the many successes of Cleaner Production, but they mask the existence of the millions of inefficient, polluting and dangerous industrial facilities that continue to operate. The voluntary nature of Cleaner Production programmes means the concepts can only reach enterprises that are open to embracing environmental values. For Cleaner Production to become more widely adopted among all sectors of industry, there need to be credible "sticks" as well as attractive "carrots".

Performance measurement

Cleaner production programmes have been instituted in a wide array of firms and institutions. There are many case reports on their successes. Yet these programmes lack common metrics for measuring performance. They are seldom assessed against their full costs, and there is little possibility to compare one project against another to determine the effectiveness of differing strategies. Few government programmes publish annual trend reports on their environmental impacts, and even fewer have been evaluated for cost-effectiveness. The highly contextual character of Cleaner Production programmes makes it difficult to develop common metrics or units of analysis. Without measuring performance against financial or environmental objectives, the specific impacts of cleaner technologies and practices cannot be effectively assessed.

Interest in corporate environmental reporting and sustainability indicators is growing rapidly (Bennett and James, 1999; Bell and Morse, 1999). Professional bodies, including Dow Jones, the American Institute of Chemical Engineers (AICE), the Social Venture Network and the World Business Council for Sustainable Development (WBCSD), have developed environmental indicator systems for corporations. The Coalition for Environmentally Responsible Economics (CERES) is developing an ambitious Global Reporting Initiative to track corporate environmental performance. These efforts suggest how useful and feasible indicators of Cleaner Production might be; they should inspire Cleaner Production promoters to work towards developing such indicators.

Workplace safety

Workplace safety remains a serious problem in much of the world. The International Labor Organisation (ILO) estimates that 125 million workplace accidents occur annually, resulting in 10 million crippling injuries and over 220,000 fatalities (600 workplace fatalities per day worldwide). The economic losses from these accidents average around 3% of GNP in many countries. In the US, the General Accounting Office estimates that the cost of disability insurance payments exceeds a billion dollars per week (Taqi, 1996). Although industrialized countries with strong labour movements have instituted regulatory health and safety and worker compensation systems, the risk of occupational injury, illness and death remains significant in many parts of the world.

For the most part, Cleaner Production programmes have ignored occupational health and safety issues (Ashford, 1997; Roelofs, 1999). The vast majority of articles, books and manuals relating to Cleaner Production are silent on workplace safety. While reduced toxic chemicals use can have beneficial implications in this area, such reductions can also introduce unanticipated new ergonomic hazards or changes in work, increasing employee insecurity. Improvements to a facility's environmental performance should not ignore or increase risks to employees. As Cleaner Production becomes more widely accepted, it will be increasingly important to ensure that environmentally sound production also means physically safe workplaces.

Economic development

Cleaner production is promoted as a means of improving business as well as environmental outcomes. However, upper management in most production enterprises thinks little about environment and health factors when decisions about new markets, increased production, new products, corporate acquisitions or new financial business opportunities are made. Most product marketing decisions are not conditioned by considerations of process hazards, ecological effects or product disposal.

Cleaner production has gained acceptance among a select group of leading firms in the

industrialized centres of the North. Nevertheless, the CP concepts' low penetration into the offices of most corporate managers means that little attention is given to Cleaner Production in investment, banking or international trade discourse. Those who control finance capital are focused on economic performance indicators. For them, non-monetized environmental or health considerations are external to the market and secondary to economic development. Global and regional trade agreements such as the North American Free Trade Agreement (NAFTA) and the General Agreement on Tariffs and Trade (GATT) have systematically separated environmental and health values from investment and finance decisions. If Cleaner Production is to achieve wider acceptance among business managers, it will need to be better understood and more consciously embraced by the international finance and trade communities.

Social consumption

The fact that we are consuming more resources than the Earth can regenerate is well recognized (Commoner, 1990; Durning, 1992; Meadows, et al., 1992). While energy is used more efficiently in some countries than it was 20 years ago, and populations have stabilized in some countries, the problem of total global over-consumption remains acute. This problem is aggravated by the profound inequity of consumption patterns, the richest 20% of the world's population accounting for 70% of total global resource consumption (Miller, 1995). There have been calls for a reduction in the rate of consumption in industrialized countries by a factor of four, ten or even 20 over the next 50 years (Schmidt-Bleek, 1994; OECD, 1997; Reijnders, 1998).

In the last several years, advocates of Cleaner Production, notably UNEP's Cleaner Production Programme, have initiated dialogue on the issue of sustainable consumption. Sustainable consumption is about the scale of throughput, but also about who enjoys the benefits of material consumption. As developing countries become more affluent, new populations will seek to mimic the material throughput standards of today's wealthy economies. The result will be demand for raw materials, spatial congestion, and a waste stream far beyond the planet's capacities.

Cleaner production leads to increases in resource efficiency and deceases in waste generation, reducing the environmental burdens of industrial production. However, steady growth in consumption required increases in the aggregate level of production that could wipe out the impacts of these process improvements. It makes little sense to promote Cleaner Production without seeking to reduce consumption levels, particularly in the wealthier economies.

Future Cleaner Production opportunities

The past few decades have witnessed significant advances in identifying and understanding a wide range of environmental problems: climate change, global pollution, habitat loss and over-population. The task ahead will require less attention to problem characterization, and more attention to solution development and facilitation. Creative solutions are needed in respect to population control, conflict resolution, habitat protection, land use patterns and poverty alleviation. It would be useful here to consider three rather conventional environmental objectives that will require progress over the next decade: detoxification, dematerialization and decarbonization.

Detoxification

Conventional approaches to industrial processes have tolerated the use of highly dangerous chemical substances without asking serious questions about their necessity and alternatives. The conventional regulatory and scientific approach to the hazards of toxic substances has been to invest in seemingly endless and almost never conclusive studies of the nature of their toxicity, the significance of their risks, and levels of exposure that should be acceptable.

Cleaner production programmes have mercifully avoided such unsatisfactory debates. Instead of ruminating over acceptable risks of exposure, Cleaner Production programmes have more creatively sought alternatives to the well recognized toxic substances and promoted production processes that avoided them. In so doing, Cleaner Production programmes have promoted aqueous processing, photo-sensitive catalysis, renewable materials, and biodegradable products.

Knowledge about toxic substances has advanced dramatically during the past 25 years. We know that many highly persistent and bioaccumulative substances (e.g. various metals and aromatic hydrocarbons) are likely to be carcinogens, to present reproductive hazards, and/or to be neurotoxins. Corporations such as Ecover, Nortel, Interface, S.C. Johnson and Philips Electronics have made great strides in reducing the toxicity of their products and processes. Baxter, Mattel and General Motors have pledged to eliminate polyvinyl chloride (PVC) in some products. Several EU countries – the Netherlands, Sweden, Denmark and Germany – have developed lists of problem chemicals ("black" or "grey" lists). The US has established a list of chemicals that are "persistent, bioaccumulative and toxic". A draft United Nations Convention on persistent organic pollutants (POPs) has recently been agreed.[1]

Many Cleaner Production programmes use lists in an informal way to identify substances that should be avoided. This "alternatives preferencing" provides an excellent example of the "precautionary principle". The precautionary approach is to take action to avoid risks even where information is incomplete. Toxics use reduction programmes in the US, and the "substitution principle" in the Scandinavian countries, encourage shifts away from recognized chemicals of concern. Avoiding use of toxic substances where other substances could deliver the same performance demonstrates the value of precaution. Through alternative assessments, life-cycle assessments and full-cost analyses, Cleaner Production programmes can promote precaution by demonstrating the utility of less hazardous production and less toxic products (Raffensperger and Tickner, 1999; Gottlieb, 1995).

Dematerialization

If industrialized countries are to take seriously the proposal to cut material throughput by a factor of four or more, substantial efforts will be needed to reduce process wastes, increase materials recycling, increase material use intensity, and create products with social value using far less material. The huge amounts of waste created during extraction of renewable and non-renewable natural materials and the synthesis of petrochemicals need to be sharply reduced through new extraction and synthesizing procedures, or those wastes need to be used as co-products.

Materials recycling is already increasing in most industrialized countries. Paper, lead and steel have been recycled profitably for years. Primary lead production has remained fairly stable in market economies over the past 20 years, while secondary production has increased about 4% per year; today over half the lead consumed comes from recycled material (UNEP, 1994). In the US 66% of all lead, 57% of iron and steel, and 42% of aluminium is recycled. In terms of products, this means that 96% of lead-acid batteries, 57% of steel cans and 63% of aluminium beverage containers are recycled (US Geological Survey, 1999; US EPA, 1998).

Material use intensity is attracting a great deal of attention among those interested in sustainable product design or eco-design. Products that are lighter, smaller, more durable, more versatile, human-powered, reparable, recyclable or reusable can reduce the ecological footprint on the Earth's natural resources (US OTA, 1992; van Weenen, 1997). Clean products are the first requirement of new product-oriented environmental management systems that employ life-cycle approaches to evaluate the environmental impacts of a product from "cradle to grave" (or "cradle to cradle" in the case of materials). In sophisticated product management systems such as those required in the Netherlands, all the market actors – producers, retailers, consumers, waste managers – are involved in reducing the product's environmental impacts. In the case of packaging, automobiles, and (soon) electronic products, for instance, European producers have primary responsibility for their products through Extended Producer Responsibility or "take-back" schemes (van Berkel, van Kampen and Kortman, 1999; Davis, Witt and Barkenbus, 1997).

It is not just products that are subject to dematerialization. Those who promote eco-efficiency are promoting material use intensity in production processes to achieve maximal production, as well as integrated production that yields several products of commercial value from one production process (Fussler, 1996). The surge of interest in "lean production" has also served to promote materials use efficiency (Romm, 1994).

Cleaner Production can promote dematerialization by focusing attention on the materials of production and the constituents of products.

Integrated supply chain management, Extended Producer Responsibility and integrated product policies offer tools for materials conservation by linking suppliers to customers to secondary consumers. Conventional waste reduction and waste recycling programmes are good examples of dematerialization. But so are increased production efficiency and lighter-weight, better tailored products.

Decarbonization

Over the recent period of industrialization, the concentration of CO_2 in the atmosphere has increased from 280 to 350 parts per million (ppm). This build-up appears to be due largely to burning of fossil fuels. It is estimated that annual CO_2 emissions from worldwide combustion of fossil fuels is equivalent to 6 billion tonnes of carbon. Most atmospheric models predict that increasing levels of carbon in the upper atmosphere will reduce the Earth's ability to dissipate heat (i.e. the "greenhouse effect") and result in dramatic local and regional climate changes (IPCC, 1990; Manabe and Stouffer, 1993). Already the eleven highest average annual global temperatures on record have occurred since 1983; the five hottest consecutive years were 1991 to 1995, and 1998 was the hottest year recorded since global temperatures have been monitored.

Efforts to slow and stabilize carbon build-up in the atmosphere will require substantial restructuring of global energy generation and consumption patterns. While electricity generating utilities and transport vehicles are important sources of atmospheric carbon, a significant contribution is also made by industrial production facilities.

The commitments to reduce greenhouse gas emissions agreed at the 1997 Kyoto Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC) established a set of national goals that could be met by capturing and sequestering greenhouse gases and "decarbonizing" the world's economies. Decarbonization can be achieved by reducing energy consumption through efficiency improvements and energy conservation, or by a shift in energy sources from oil and coal to natural gas (chiefly methane), hydrogen or renewable sources (e.g. hydro, solar and wind).

Some of the world's largest oil and auto companies have begun to address the need to change energy technologies.[2] British Petroleum/Amoco has made a commitment to conduct $1 billion per year in solar commerce by 2010. Shell has created a new company to produce renewable solar technologies. Ford and Daimler/Chrysler have joined with Ballard Power Corporation to produce fuel cell-powered cars in the next three years. Both Honda and Toyota are now marketing 60 to 70 mile per gallon hybrid cars (Gelbspan, 2000).

Clean production can promote decarbonization through increased attention to energy conservation and energy utilization efficiency in both production processes and product design. For instance, process heat recycling systems offer opportunities for interior climate control, as well as reductions in energy requirements for raising and maintaining processing temperatures. Motors and motor systems represent a significant opportunity for energy savings. Motors use a great deal of energy; in the US they consume some 70% of all industrial energy. Because so many of today's operating motors are inefficient – many use up to 20% of their capital costs in energy costs every year – a Cleaner Production focus on motors can yield significant benefits. Lighter-weight materials in products and packaging recycling or reduction programmes reduce energy requirements for product transport. Advances in thin-film photovoltaics offer new possibilities for solar energy conversion devices that are likely to be quite cost competitive. Where production facilities convert to fuel cells or renewable energy sources, greenhouse gases are reduced or eliminated. Finally, the Internet and the significant strides in electronic technologies offer many rich opportunities for changing the economy so as to reduce greenhouse gas generation, although there are also opportunities to go the other direction as well (Horrigan, Irwin and Cook: 1998, Cohen, 1999).

Longer-range goals for Cleaner Production

Some other goals are equally important, but will require longer-term commitment and may only get started during the next decade:

- Cleaner production needs to be more effectively promoted within the investment and trade communities. It needs to be advocated as an investment strategy and as a factor of competition. This will require a reorientation of banking and investment philosophies, and the rewriting of international trade agreements.
- Promotion of cleaner and safer forms of production needs to be coordinated with a parallel and proportional promotion of sustainable consumption directed at cutting material and energy consumption, particularly in the more economically developed countries.

These are ambitious goals, but plenty of foundation work has already been done. This next decade could well be a time of rapid changes, as firms and governments re-draft their missions and re-direct their functions. The past decade has raised awareness enormously about environmentally conscious production and proved its economic value. The agenda ahead is to move from broad awareness and successful pilots to making Cleaner Production a part of conventional economic and social practice.

Notes

1. See http://www.chem.unep.ch/pops.
2. See the special "Sustainable Mobility" issue of *Industry and Environment*, Vol. 23, No. 4 (October-December 2000).

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Sustainable consumption and Cleaner Production: two sides of the same coin

Summary

A "life-cycle economy" is an integrated approach to sustainable production and consumption policies. Working within this framework means addressing both sides of the coin (i.e. sustainable consumption and Cleaner Production) to make sure the most efficient tools and strategies are applied. National Cleaner Production Centres have an important role to play in this area.

Résumé

Une économie basée sur le cycle de vie est une approche intégrée des politiques de production et de consommation compatibles avec un développement durable. Inscrire son action dans ce cadre signifie prendre en compte les deux faces de la médaille (c'est-à-dire des modes de consommation durables et des modes de production plus propres) si l'on veut réellement appliquer les outils et stratégies les plus efficaces. Dans ce domaine, les Centres nationaux de production plus propre ont un rôle majeur à jouer.

Resumen

Una "economía de ciclo de vida" es una aproximación integrada a las políticas de producción y consumo sostenibles. Trabajar dentro de este marco implica dirigirse a ambas caras de la misma moneda(es decir, consumo sostenible y producción más limpia) para garantizar que se apliquen las herramientas y estretegas más eficaces. Los centros nacionales de producción más limpia desempeñan un rol importante en este área.

Once we recognize that production and consumption are two sides of the same coin (see Chapter 4 of Agenda 21, adopted at the Earth Summit in 1992), the need for policies and strategies that encourage changes in current consumption and production patterns is obvious. By working within a consumption and production framework, one is also applying the concept of a "life-cycle economy". A life-cycle economy provides an integrated approach to sustainable production and consumption policies. UNEP's sustainable consumption programme applies the "life-cycle approach" to consumer needs. It focuses on understanding the driving forces behind consumption, using them to inspire cost-effective improvements, and improving quality of life in every part of the world. In May 2000, the Global Ministerial Environment Forum in Malmö, Sweden, which endorsed the use of such an approach worldwide, asked UNEP to prepare an action programme which would give country guidance in implementing it.

As demonstrated at UNEP's First African Roundtable on Cleaner Production and Sustainable Consumption (Nairobi, Kenya, August 2000), the priorities relating to consumption vary in different parts in the world. In developing countries, the first priority is increased access to everyone's basic needs. Over a billion people live on less than a dollar a day. For them, sustainable consumption means consuming more. Basic resources are often used very inefficiently by those who are most impoverished. They cannot act in any other way. Making it possible for people to consume *differently* is a challenge that needs to be addressed by the international community, as well as the wealthier part of the population in developing countries.

In industrialized countries, which agreed in Rio in 1992 to take the lead in promoting the sustainable consumption agenda, the issue of "sufficiency" needs to be addressed, i.e. how to move from consumption patterns based on quantitative values ("more is always better") to enlightened consumption based on qualitative values ("quality over quantity").

Review of status

Chapter 4 of Agenda 21, "Changing Consumption and Production Patterns", set the stage for much of the ensuing debate on sustainable consumption and Cleaner Production. The UN's international work programme on sustainable consumption and production patterns, adopted in 1995 by the third session of the Commission for Sustainable Development (CSD), defined sustainable consumption as *"the use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations".*[1]

Thus, sustainable consumption has economic, environmental and social dimensions, emphasising the significance of environmental constraints and the requirement to address the needs of the poor simultaneously.

The OECD workshop at Rosendal, Norway in June 1995 on *"clarifying the concept"*, as well as later activities concerned with analyzing the conceptual framework, have helped the international community focus on key terms. The conclusion from Rosendal was that some of the various concepts under debate actually project the same message. They all boil down to looking at the impact of consumption and the natural capital requirements of an economy, based on an interpretation of carrying capacity.[2] The term "eco-efficiency" was chosen to *"bring about a significant decoupling of consumption and production from raw material input and pollution output."*[3]

In the late 1990s, UNEP started to explore linkages between consumption and Cleaner Production activities, which had so far focused mainly on the supply side of manufacturing processes. Growing awareness has drawn attention to the demand side and consumers' need for cleaner products and services. UNEP has therefore found it useful to work with communication experts, apply tools that inspire stakeholders to take action (e.g. eco-design, product service systems), and address awareness-raising and education in order to communicate about the issue.

The International Declaration on Cleaner Production encourages both sustainable production and sustainable consumption practices. It also calls attention to the need to find innovative Cleaner Production solutions *"by supporting the development of products and services which are environmentally efficient and that meet consumer needs".*[4] CP5 recommended that UNEP work on analyzing the driving forces behind consumption to facilitate change, in order to gain a better insight into the development of indicators and the understanding of emerging trends.

UNEP is collecting data for the finalization of two research projects on consumer behaviour and trends concerned with young people and with the "Global Consumer Class".[5] The aim of those studies is to identify consumer perspectives, choices and expectations around the world. The UNEP Youth Research Project has been designed to analyze young people's consumption patterns and their approach to sustainable consumption. The project addressing the global consumer class seeks to determine whether any major similarities exist between consumers across national borders, and to study the attitudes of global consumers to sustainable consumption. It will evaluate specific elements involved in the consumption patterns of

the global consumer class and demonstrate public opinion on possible policy initiatives.

CP5 recommended that UNEP facilitate sustainable development by encouraging new ways of doing business and identifying key networks worldwide to promote links to facilitate information exchange. UNEP took the initiative by establishing a network of experts on sustainable consumption, the "Kabelvåg network", following the June 1998 expert meeting in Kabelvåg, Norway. This network is administered via a list serve operation. There is a web-based newsletter every three weeks. The objective is to provide a forum for experts on sustainable consumption news, ideas and questions.

CP5 considered that information and education are critical in order to change consumption patterns. UNEP is now working with Carl Duisberg Gesellschaft, UNESCO, and other partners to identify training needs and develop material to educate and raise awareness. Business and governments in developing countries need to identify tools and strategies to enforce sustainable consumption and Cleaner Production patterns based on their own cultural frameworks. To further support this work, UNEP is organizing roundtables and workshops around the world to develop regional action plans to be put forward at RIO+10 in 2002.

Potential and relevance

The UNEP/UNIDO National Cleaner Production Centres (NCPCs) play a key role in training and in bringing local capacities together. UNEP would like to work with NCPCs to address the need for life-cycle thinking by business, and to help them develop tools to implement changes to take advantage of new opportunities. This initiative has already been introduced through the Roundtable on Sustainable Consumption and Production in Nairobi.

Working within a life-cycle economy framework means addressing both sides of the coin – sustainable consumption and Cleaner Production – to make sure the most efficient tools and strategies are being addressed.

Opportunities and constraints

Some opportunities common to CP and sustainable consumption include making use of local resource and knowledge bases, and working within the parameters of what nature provides by using renewable materials and energy. Moreover, opportunities can be identified, when working within a life-cycle framework, for applying cleaner and safer production practices to minimize pollution. Sustainable consumption and production opportunities may come from mainstream economic development, as this provides the income and employment needed to eradicate poverty and improve the quality of life of citizens worldwide. It makes sense to try and avoid the mistakes made by developed countries on the path to industrialization (through "leap-frogging"). Developing countries could make use of the strengths of industrial development, while building on increasing awareness among the world's consumers of the environmental and social aspects of the products they buy.

Constraints on sustainable consumption patterns can be grouped as economic constraints, structural constraints, and constraints due lack of information and communication. Economic challenges are associated with such factors as product prices and taxation schemes. With respect to structural dimensions, many countries lack an efficient infrastructure and policy platform to address environmental issues (e.g. waste management, energy and transportation) efficiently. Governments have to do their job by creating a productive framework, and UNEP would like to help. Awareness on the part of government, business and consumers, which is needed to make informed changes, should be improved. As a response, communication strategies are being explored and an initiative to promote the tool of life-cycle assessment will be developed. This helps organize the quality and accessibility of environmental information.

CP and sustainable consumption: common issues

"Life-cycle economy" implies an integrated approach aimed at putting various tools, for both consumers and producers, in perspective. Some of the tools and activities on which UNEP is working are mentioned above. Four main theme areas will be addressed here:

- perspectives of South and North;
- stakeholders and tools;
- communication and information; and
- the role of design in making better products that reflect consumer needs.

Differing perspectives: North and South

The concepts and tools needed to address sustainable consumption patterns have primarily been developed in the North, which agreed to take the lead at Rio. However, it has become clear that developing countries also need to consider their consumption patterns to avoid the North's mistakes, as well as to identify new opportunities for economic development. In the North, sustainable consumption is often perceived as consuming differently, consuming more efficiently and consuming better. This does not necessarily take on board all the relevant dimensions for developing countries, where the primary concern is meeting citizens' basic needs. Other fundamental concerns include poverty reduction, population growth and economic development. The World Bank points out in a recent *World Development Report* that poverty reduction requires reducing inequality and protecting vulnerable groups, as well as promoting economic growth.

In view of the differing starting points for North and South, there are also different driving forces for sustainable consumption. The main forces in the North might be identified as government regulations, consumer demand for better products and services, business's desire to make its consumption more efficient in order to achieve both financial and environmental savings, and demand from society in general for greater corporate responsibility.

In the South, business and government motivation may come from international and national regulation, the prospect of attaining new export markets, environmental and financial savings, efficient management of natural resources and new technology, and economic and social development.

For consumers in the North and South alike, some motivating factors may be better information and education relating to environmental issues, health concerns, the need for infrastructure, peer pressure, financial savings, and an overall improved quality of life.

In changing their consumption patterns, the North and South have a lot to learn from each other through coming to understand better the many different cultural frameworks and ways of taking action and addressing change. Drawing on indigenous knowledge and skills worldwide will undoubtedly provide added value to the knowledge base. This can offer new opportunities for business, as well as different strategies and frameworks for society, bringing us a step closer to sustainability. To secure such opportunities, developing countries need access to information, training and technology by means of new cooperation between North and South. In short, addressing sustainable consumption and changing consumption patterns is by no means a one-way street. It means paying attention to each other, to development, to nature, and not least to cultural frameworks and the needs of people.

In the last few years, we have seen what we might call a global consumer class emerge. This global group is made up of consumers who share certain elements of a common lifestyle (i.e. access to IT and purchasing of similar products) regardless of who they are and where they live. The evolution of a class of global consumers means we now have to reconsider the normal parameters of thinking in terms of North and South perspectives. It forces us to look at social and cultural circumstances across national borders, recognizing that the divisions are to a greater extent between rich and poor than between North and South.

Stakeholders and tools

Changing consumption and production patterns is not exclusively the task of a certain societal group. Businesses, governments, communities, research institutes and households all need to be involved, and ways to work together need to be identified.

Stakeholder approaches add an important dimension to the life-cycle economy. Using both approaches, policy-makers will be able to make better informed decisions. Decisions concerning consumption and production are made at all levels of society (e.g. by individuals, companies, national and international communities and organizations). The objective is to identify opportunities and strategies that might be addressed by each agent.

For *individuals* the main objective is to address consumption patterns by looking at issues such as

transportation, consumption of non-renewable resources, energy carriers, and products that are indicators of citizens' quality of life. By considering the impacts of day-to-day activities, consumers may be able to select better products and use resources more sustainably. For example, they can contribute to improved material efficiency through waste separation and material recovery systems.

Non-governmental organizations and citizens groups play a central role in contributing to awareness raising, information provision, lobbying and networking. Today a number of NGOs address social, cultural, economic and environmental issues. Consumer organizations in developed countries began to lobby for food security and health issues many years ago. They gradually realized that these issues are often linked to the environmental agenda.

Young people are important actors in civil society. Therefore, UNEP is working with them to develop a sustainable consumption strategy. We are thinking of people between 18 and 25 years of age: 40% of the world population is under 20, and in many developing countries children and youth represent the majority of the population. Young people represent an enormous potential due to their creativity, enthusiasm and strength, and international environmental policies are benefiting from this.

Young people will be decision-makers in the future. Their thoughts and consumption patterns are critical for the world of tomorrow. Some central questions addressed by youth all over the world are: why do we consume as we do? how can consumption patterns be made more sustainable? and what power do we have as consumers to influence companies and governments towards a more sustainable path.

The UNEP youth and sustainable consumption strategy seeks to encourage and stimulate changes in consumption patterns through various activities, including a campaign on sustainable consumption, a research project to map the attitudes of young adults towards sustainable consumption, and making sure the voice of youth is heard at international meetings relating to sustainable consumption and Cleaner Production.

Several types of tools address consumption patterns in *business and industry*. In general, they can be grouped in three categories:

- those concerning the organization itself (i.e. EMS, standards, codes of conduct, voluntary initiatives, negotiated agreements, environmental and social reporting);
- those concerning products or services, which deal primarily with optimizing energy and material consumption through waste minimization and pollution prevention (i.e. Cleaner Production, eco-efficiency and dematerialization), and with selecting the right materials and providing the right information (i.e. through LCA, eco-design, indicators, eco-labelling). A primary objective is focusing more on a life-cycle economy and less on short-term profits.
- "re-thinking", or redefining core business activities according to the underlying needs of consumers (i.e. through stakeholder dialogues, addressing new solutions within the supply chain, technological capacities and innovation, industrial ecology, and investment strategies).

At the level of *the public sector*, consumption patterns can be addressed through regulations, taxation, labelling schemes, policy recommendations, stakeholder dialogues and voluntary initiatives. Governments might wish to use tools to improve analysis, and public and business awareness-raising, as well as monitoring activities and providing feedback to society by developing and applying, for example, general indicators, standards, environmental education and information campaigns. Moreover, governments can provide incentives to the public and business by means of economic instruments, eco-labelling schemes and negotiated agreements with business, as well as through regulations and legislation. They can also improve their own operations through, for example, green procurement and integrated product policy. Finally, it is essential that governments work with others with respect to regional and international relations.

It is becoming clear that the tools for promoting sustainable consumption and production patterns are as diverse as the subject itself. Consideration must also be given to country-specific circumstances. Generally speaking, tools to bring about change should be linked to the process of change itself. Decision-makers (in governments, business and households) will only be prepared to change if they 1) know about the problem, 2) want to change, and 3) are able to achieve their intentions.

Information and communication

Businesses are increasingly recognizing the need to act responsibly with respect to consumers. This is not only because they feel they have a moral obligation, but also because there is increased demand for them to do so from consumers. The relationship between producers and consumers is increasingly based on trust. Companies recognize that this provides them with new ways to do business in an aggressive marketplace. There is great potential for companies to gain competitive advantage through incorporating sustainability and social issues.

To help consumers make informed choices, eco-labelling and voluntary information campaigns have been introduced. The large amount of information (and debates about its quality) have a tendency to undermine the effect of labelling. However, some labelling schemes have successfully influenced consumers, such as the White Swan label in Nordic countries and the Forest Stewardship Council (FSC) label found on sustainably harvested timber.

The International Association for Soap, Detergent and Maintenance Products (AISE) has introduced a voluntary initiative called the "Wash Right Campaign". AISE represents national associations and their member companies in 28 countries, mainly in Europe. Its campaign has successfully reduced consumption of energy, water and laundry detergent between 5 and 10%. As of March 2000, over 90% of the European market (representing over 150 companies, including multinationals and their subsidiaries) was committed to the Code. Companies have undertaken this initiative in order to continue to improve their environmental progress when formulating products and packaging for household laundry detergents, and to encourage consumers to be more closely involved in proper product use.

Communication tools applied through advertising and marketing strategies are well established mechanisms for affecting consumer choices. This is why the communication experts are also key in identifying tools and strategies needed to encourage consumers to make more environmentally-friendly choices. The advertising and communication sector is the link between producers and individual consumers. It influences [illegible] communication strategies, and its communication skills and creative talent are an important asset that can help change consumption patterns. Moreover, the media play a key role in improving knowledge and generating interest among consumers.

Design: a source of inspiration

Cleaner, safer and more eco-efficient products and services can be produced. Product design can be an effective tool for use in achieving more sustainable consumption patterns, in that it addresses all stages of product development as well as taking consumer needs into account. When based on environmental data provided by tools such as life-cycle assessment, design can play an important role in reducing energy and material throughput in the economy. Design concerns most factors of the performance and composition of a product or process, including efficiency, multifunctionality, reusability, recyclability, and material and energy use.

The objective of eco-design is to make product and service development an ecologically sound processes. Many companies are increasingly recognizing the value of doing this to gain competitive advantage. A focus on design through product service systems (PSS) can foster enhanced ability of companies to address consumer demands, efficiency improvement and new technology. Products designed "from cradle to cradle" present challenges in both developed and developing countries. PSS can be defined as a marketable set of products and services, jointly capable of fulfilling a client's need, to assist in reorienting current unsustainable trends in consumption and production. Ideally, a mix which increases emphasis on the service component will reduce environmental impacts while providing economic benefits. For instance, in a recent workshop organized by Carl Duisberg Gesellschaft, and sponsored by UNEP, participants concluded that there is a need for more training and awareness raising about the potential of eco-design among those in the product design area. Almost echoing the expert meeting on Product Service Systems organized in June, participants pointed out the importance of exploring the role of cultural adaptations in product design, increasing general awareness on the part of business and government decision-makers, and determining which tools and instruments can

facilitate action.

Addressing product service systems as a strategic framework offers an opportunity to increase efficiency and thereby "leap" to more sustainable production and consumption patterns. In short, replacing a product with a service does not necessarily allow the best solution. Sometimes optimizing environmental performance, while responding to consumer demands, requires a combination of products and services. There is considerable experience and material to draw on in developing tools in the areas of product development, eco-design and life-cycle assessment. To ensure a more complete approach, these concepts could be tackled in combination with, for example, stakeholder analysis, supply chain management and Cleaner Production.

Conclusion

CP6 provided an opportunity to address the interrelatedness of sustainable consumption and Cleaner Production with high-level policy-makers from throughout the world. What are the best next steps to address these issues efficiently?

UNEP plans to use the NCPC network to extend its consumption activities in the regions. More broadly, working within the framework of a life-cycle economy requires focusing on both sides of the coin – sustainable consumption and Cleaner Production – to make sure the most efficient tools and strategies are being considered. A life-cycle economy should be the guiding principle for business and governments. There is a need to further develop and implement tools to operationalize a life-cycle economy (i.e. LCA, eco-design, PS systems). Research presented in several reports (i.e. GEO2, GEO3 and the *Human Development Report* from 1998) emphasizes that the Earth's carrying capacity is already under stress as a result of current consumption patterns. This is a concern when considering the requirements of generations to come. We know there is an urgent need to promote sustainable consumption patterns, which means changing lifestyles for consumers and the taking actions for governments and industry.

At CP6 it was suggested that there is a need to define sustainable consumption clearly (e.g. better, efficient, different), especially with respect to developing countries. There is a need to better understand consumption drivers, and to communicate about them more efficiently. Consumption patterns should be broken down into more manageable segments, so that changes can be identified and experiences circulated. Age-specific consumption patterns should also be addressed in depth. Through collecting best practice examples, UNEP should disseminate information highlighting new business opportunities in design and product-service systems. To address these issues, UNEP should initiate training and networking tools (including LCA), develop a voluntary initiative for the advertising industry, and engage in stakeholder dialogues to generate a vision of sustainable consumption worldwide.

Notes

1. Third Session of the Commission for Sustainable Development (1995).
2. Organisation for Economic Co-operation and Development (1997) *Sustainable Development. OECD Policy Approaches for the 21st century*. Paris.
3. World Business Council for Sustainable Development (1998) *Sustainability in the Market*, Geneva.
4. UNEP International Declaration on Cleaner Production (1998). See the special issue of *Industry and Environment* on Cleaner Production (Volume 21, No. 4, October-December 1998), published following the Fifth International High-level Seminar at Seoul, Korea, on 29 September-1 October.
5. See the issue of *Industry and Environment* on sustainable consumption (Volume 22, No. 4, October-December 1999). In addition, see Matthew D. Bentley, Consumer trends and expectations: an international survey focusing on environmental impacts, *Industry and Environment* Volume 23, No. 4 (October-December 2000).

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Cleaner Production: government policies and strategies

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Summary

Policy interventions in the future could bring about increased (and accelerated) adoption of Cleaner Production. A brief overview of major policy instruments in use or under development is presented. Generally speaking, policy instruments belong to one of three groups: regulatory (administrative or directive-based); economic (incentive-based); or informative (information-based). In practice these types of instruments are likely to be combined rather than applied in isolation. Decision-makers can profit from greater knowledge of how such instruments have been applied in other countries.

Résumé

Dans le futur, l'intervention des pouvoirs publics pourrait stuimuler (et accélérer) l'adoption de la production plus propre. On trouvera ici une présentation succincte des principaux instruments d'action publique en usage ou à l'étude. Dans l'ensemble, les instruments d'action publique appartiennent à l'une des trois sphères suivantes : réglementaire (décisions administratives ou directives), économique (système d'incitations) et informative (information du public). Dans la pratique, il est probable que ces instruments seront employés en association plutôt qu'isolément. Les décideurs ont tout à gagner de mieux connaître leurs modes d'utilisation dans d'autres pays.

Resumen

Políticas de intervención futuras podrían generar el aumento (y la aceleración) de la incorporación de métodos de Producción más Limpia. Se presenta una breve reseña de los principales políticas instrumentales vigentes o en vías de desarrollo. En general, estas políticas instrumentales pertenecen a uno de estos tres grupos: regulatorias (administrativas o basadas en normativas); económicas (basadas en incentivos); e informativas (basadas en la información). En la práctica, este tipo de políticas instrumentales se aplican en forma conjunta y no de manera independiente. Conocer cómo se aplican estas políticas en otros países puede beneficiar a los responsables de la toma de decisiones.

Policy instruments that promote Cleaner Production are not fundamentally different from other policy instruments. However, they must be wisely conceived in order to favour preventive rather than end-of-pipe approaches.

The Cleaner Production concept is as important for solving problems in the product and service areas as it is for addressing problems relating to production processes at industrial facilities. Indeed, it should be understood that the success of the preventive approach largely depends on the ability to mainstream the CP concept into major policy areas beyond environmental policies.

You can still find people who question the severity of environmental threats. However, there is a general consensus on the need to deal with environmental problems more vigorously. Which problems should have priority, and how to address them, are much debated. It is here that more knowledge and ideas are needed.

When consensus is reached on the need for preventive action to reduce the environmental burden in a specific area, this message must be transferred to all decision-makers and actors implementing the activities in question. Society transfers such messages by formulating and putting into action various policies and strategies. Their operative content determines the sets of policy instruments that will create incentives for the actors in question to change their behaviour in the necessary direction.

The range of available policy instruments

In fact, the range of policy instruments is very limited. Broadly speaking, all policy instruments could be said to belong to one of three groups:

- *Regulatory* (administrative or directive-based) instruments specify what various actors are allowed to do, or not to do, and how certain activities should be conducted;
- *Economic* (incentive-based) instruments create positive or negative incentives for certain activities by adjusting the financial conditions surrounding those activities; and
- *Informative* (information-based) instruments are based on the assumption that actors are not rational, owing to lack of knowledge or awareness. They aim at compensating this deficiency through provision of better information.

The various policy instruments are not used in isolation. Regulatory instruments are often associated with fines for non-compliance, economic instruments need a legal framework, and information is necessary to the implementation of all types of policy instruments. However, for the purposes of this article the definitions above will serve well.

The range of instruments available is illustrated in **Figure 1**. It should be noted that this is a selection: all existing policy instruments are not included. This figure also shows a number of environmental tools such as life-cycle analysis (LCA) and environmental management systems (EMS) that could be part of policy interventions. For instance, a government policy could introduce mandatory EMS or allow regulatory relief if companies introduced an EMS according to specified demands.

It is not only in the context of government policies and international agreements that policy instruments are of interest. Many companies and organizations could benefit from, and have introduced, instruments of this type to create incentives for subsidiaries, departments and individuals to change their behaviour.

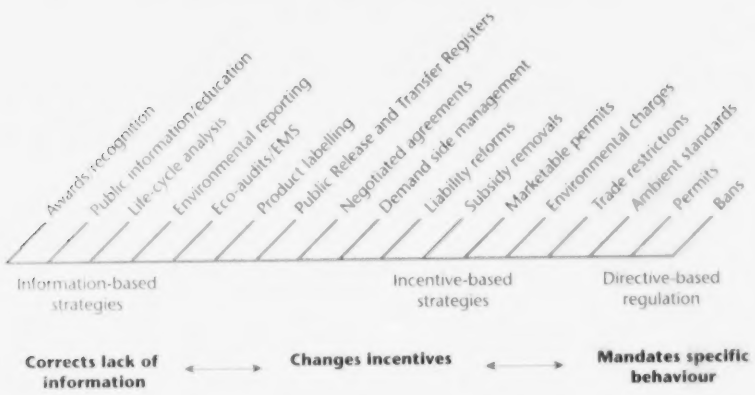
It should also be noted that both obligatory and voluntary approaches are possible using the same types of instruments. Self-regulation and other voluntary approaches are often attractive alternatives demanding fewer regulatory resources. There has been considerable interest in voluntary industry initiatives and various types of negotiated environmental agreements during the last decade.[3]

What is now typical of a policy instrument promoting Cleaner Production? The first answer is that there is no special distinction between instruments promoting Cleaner Production and those that will lead to implementation of end-of-pipe technologies. Most policy instruments available to governments have the potential to lead either way. It is the way an instrument is used in a specific case that determines whether it will provide incentives for preventive approaches. Hence, it is important to formulate the policy intervention and specific implementation of selected policy instruments carefully.

Expanding the Cleaner Production approach beyond industrial processes

Production facilities and other types of point sources have been the focus of most pollution

Figure 1
Range of instruments for environmental policy



Adapted from EEA (1997) *Environmental Agreements. Environmental Effectiveness*

abatement (as well as Cleaner Production) activities. In Sweden, significant improvements have already been made through a mixture of different approaches – preventive as well as end-of-pipe.[2] Attention has now turned to the environmental impacts of products' entire life cycles. However, it is much more difficult to quantify emissions relating to usage and end-of-life management. Statistics have not been collected in a way that would facilitate such calculations.

The problem is not simply one of statistical parameters. There are an almost infinite number of different products, not to mention the inherent (and increasing) complexity of many products. A considerable share of the products sold in Sweden are imported. Determining the relevant environmental properties of these products is even more difficult. Estimating environmental impacts is complicated by the time aspect of durable products' usage phase and of the impacts from, for instance, waste disposal sites.

Figure 2 shows how the relative importance of process-related emissions has diminished, while the level of emissions from usage and end-of-life management has continued to grow. Chromium emissions from manufacturing facilities in Sweden increased between the beginning of the century and approximately 1970 and then fell quickly, almost approaching zero two decades later. However, emissions from usage and from the end-of-life phase continued to increase throughout the entire period. After around 1970, it was estimated that these emissions dominated the total for Sweden. Chromium emissions from manufacturing were negligible in 1990.

In 1997, the Ecocycle Commission attempted to compare the emissions of metals from point sources with those from product use in Sweden. Point sources included manufacturing and waste treatment facilities and sewage treatment plants. This meant that leakage from decaying products at landfills, air emissions from the combustion of discarded products in waste incinerators, and dissolved products such as washing powders were counted as emissions from point sources.

Amounts of various metals introduced into society in the form of new products were also estimated. While these figures (as wall as the figures for emissions from usage) were not accurate measurements, they were based on the best possible estimates using available data from all relevant studies and all relevant statistics. An attempt was also made to estimate the accumulated amounts of metals in Swedish society, i.e. the amounts of various metals incorporated into products, including houses and roads and other infrastructure. The results are shown in Table 1.

Estimated annual emissions from point sources for six of seven metals were lower (considerably so in several cases) than estimated emissions from usage. It should be noted that amounts of these metals greater by one or two levels of magnitude were introduced into the technosphere each year, and that very high amounts had already accumulated at that time. For almost all metals there is continuous accumulation, resulting in huge amounts of future metal waste that will have to be taken care of some time.

It is important to recognize the implications of the information provided on environmental impacts of products. This means governments in industrialized countries must direct their policy interventions towards products and their environmental burden. It is often implied that European governments have developed product-related environmental policies in order to create barriers for non-European countries exporting products to the European market. However, acknowledging the present environmental situation, it becomes evident that the Swedish government cannot ignore the fact that today product-related problems are more severe than process-related ones.

It can likewise be shown that governments should pay increased attention to the services provided in modern society. Service industries (e.g. tourism, transport, communications) increasingly dominate modern economies. Studies show that their environmental impacts should not be neglected. However, there is also a positive message in that the Cleaner Production approach has proven as promising for addressing service-related environmental problems as process- and product-related ones.

Review of the use of policy instruments to promote Cleaner Production

The following is a short review of the current and prospective use of various policy instruments that can promote Cleaner Production in the areas of industrial processes, products and services. This review broadly follows the list of policy instruments and management tools in Figure 1, beginning with the directive-based regulations on the right side of the figure.

Bans, permits and ambient standards are traditional environmental policy approaches with a long tradition in many countries. Examples are found virtually everywhere; they are sometimes seen as the archetype of command-and-control approaches. In that context they are viewed as less progressive instruments largely favouring end-of-pipe solutions. However, as in the case of other instruments, it is the way a specific regulation is formulated that determines whether it will promote Cleaner Production or traditional abatement technologies.

By definition, bans of specified substances are very effective if they can be enforced. They can also force a change in input material. A ban is clearly a Cleaner Production measure as long as it is not used in such a way that a banned material is substituted by an even more harmful substance or process. This is obviously a risk, but it could be claimed that this risk is more theoretical today since very few substances are subject to bans or similar restrictions. The main concern is rather that procedures for legitimizing a ban are so demanding that they practically eliminate any possibilities of using this instrument at all.

Sweden is one of the countries with the most elaborate chemicals policies. A few substance bans are in effect, and a number of existing bans have been questioned in connection with Swedish EU entry. It has also been claimed that substance bans violate free trade agreements. In the foreseeable future, it appears unlikely that more than a few bans will be put in place. Many environmentalists, recognizing the problem of identifying the level of danger through risk assessments, have put their hopes in the precautionary principle. However, it seems that the present interpretation of precaution will not change the fact that suspected substances are given the benefit of a doubt. It is those calling for a ban who are required to provide evidence of a substance's harmfulness – rather than the producer who must show it is harmless.

Proponents of Cleaner Production have pointed to the problems of transferring emissions from one medium to another and urged that permits

regulating emissions to air and water, and waste management, be coordinated in one integrated permit. Developments during the 1990s followed this line in several countries, notably in the EU, where the IPPC (Integrated Pollution Prevention and Control) Directive has been implemented. The IPPC Directive has also been implemented in several countries in transition. However, it is unclear to what extent licensing authorities will be able to include Cleaner Production approaches in actual permit issuing.

Environmental charges are favoured by many policy analysts. The basic idea is simple: to internalize external costs and thus obtain prices that include full costs. Transferring theory into practice has turned out to be too difficult in several ways. Calculating generally acceptable estimates of externalized effects is still not an easy task, despite decades of attempts. Further, the political will to implement environmental charges at levels that reflect external costs has not existed in most countries. Instead, there is a general feeling that most environmental charges have been designed more to provide revenue for governments than to create effective incentives for change.

It is often suggested that revenue from environmental charges could be used to finance demonstration projects or similar activities, preferably focusing on Cleaner Production strategies. The introduction of an environmental charge would therefore have a double effect: a negative incentive with respect to the activity subject to the charge, and a positive one for the Cleaner Production measure being promoted. However, most environmental charges are not designed in this way, and there is not a general consensus among economists and policy analysts that it is a preferable way to implement environmental charges. Thus, many environmental charges ought to be called environmental taxes.

The means by which environmental charges have been developed in some countries in recent years indicates a shift in the basic idea of how these charges should be designed. Instead of determining the level of the charge based on an evaluation of externalized effects, it is argued that the level should be adjusted to secure a shift towards a politically determined goal. In this way the problem of deciding the value of the externalized effects is avoided. It is replaced by a process that could incorporate existing cost information and other relevant social concerns.

With respect to both regulations and economic instruments, the *enforcement of existing legislation* is one of the main problems in many countries. Economic instruments such as environmental charges, for instance, require a monitoring system that accurately measures emissions subject to the charges. Poor enforcement systems risk perverting the steering effects associated with environmental charges.

A considerable problem is posed by the risk of corruption. Poorly paid inspectors are tempted to accept bribes. When legislation/regulations demand unachievable emission limits, as in some of the countries in transition, all incentives for companies to reduce emissions are destroyed. There is no way to avoid paying the inspectors.

Table 1
Point emissions of metals in Sweden in comparison to emissions by usage, virgin material used for new products, and total accumulated amounts in the techno sphere

Metal	Point emissions to air and water (tonnes/year 1992)	Emissions at usage (tonnes/year)	Virgin material in products (tonnes/year)	Accumulated in society (tonnes)
Aluminium			130,000	3,000,000
Lead	400	3600	30,000	2,200,000
Iron/steel			1 - 2,000,000	>35,000,000
Copper	100	600-1100	100,000	3,500,000
Chromium	40	760-940	50,000	2,000,000
Nickel	60	4-40	10,000	400,000
Zinc	1000	1100-1400	40,000	2,500,000
Mercury	1	4	14	9000
Cadmium	3	0.12-50	170	5000

The Ecocycle Commission report points to the considerable uncertainties in the estimates of many of the figures for emissions by usage and for accumulation.

Source: Ecocycle Commission (1997)

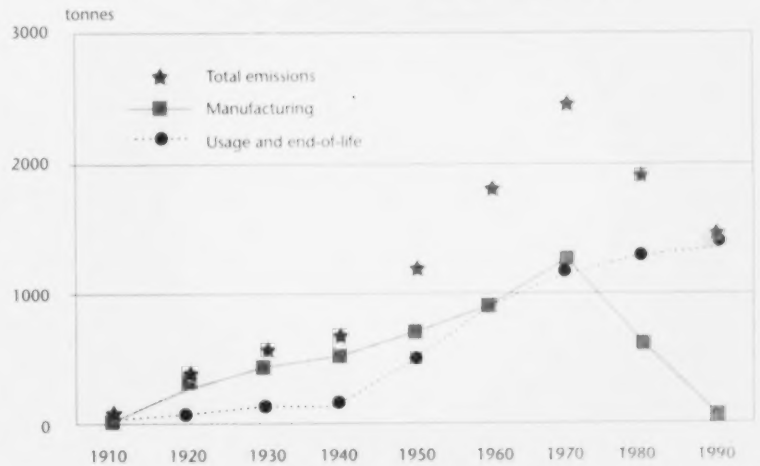
Marketable permits have the potential to ensure that measures aimed at reducing environmental impacts are selected in the most cost-efficient way. Such trading systems were much discussed in the 1990s, but few have been implemented in practice. *Joint Implementation and Clean Development Mechanisms* are examples of strategies that show the growing interest in this approach.

In many countries, the most prominent opportunities to create economic incentives for implementing Cleaner Production concern various forms of *subsidy removal*. Prices for energy, water and waste management are often low because of hidden subsidies. Experience in Central European countries has shown that adjusting energy prices, for instance, has led to substantial savings in energy use in companies as well as in service-providing organizations.

The risks of removing *traditional subsidies* should be noted. Industries accustomed to subsidized price levels for energy or water may be unable to adjust to sudden price rises. Inefficiencies associated with lower prices can be firmly implanted in the technologies used by companies and in the industry's management routines. Many industries (e.g. in economies in transition and developing countries) have found that major efforts are required to convert processes based on energy, water and raw materials subsidies so that they are competitive when the subsidies are removed. Cleaner Production offers solutions to minimize the problems with such transitions, but they could still be painful and demand a well planned transition period.

Liability can be a powerful direct economic incentive to move away from polluting technologies and unsafe products towards Cleaner Production. Several countries have found that enforcing strict liability – meaning firms are held responsible for all the environmental damage they cause, even if they have fulfilled their legal obliga-

Figure 2
Estimated chromium emissions in Sweden, 1910-90



Ecocycle Commission (1997) *Strategi för kretsloppsanpassade material och varor* (Strategy for material and products adapted for ecocycling). Kretsloppsdelegationens rapport 1997:14. Stockholm: Kretsloppsdelegationen, Miljödepartementet, Figure 21:3, p. 359.

tions – often leads to attempts to minimize risks and take preventive measures. The success of such liability systems depends on the effectiveness of the enforcement and legal system in the country concerned. This limits their applicability in many countries.

Green public procurement programmes can be implemented in all countries. Experience in several countries shows that government purchasing can provide powerful signals for product development if systematically used to promote environmental improvements. There is also an effect on major purchasers in industry and other organizations. Finally, through these programmes, better environmentally adapted products become available to individual consumers as well.

Efficient environmental protection measures may not be implemented owing to lack of knowledge and awareness. Policies promoting *public awareness and education* are therefore of fundamental importance, and are the basis for all long-term changes in society. They can include demonstration and Design for Environment (DfE) projects. However, the speed with which preventive approaches have been disseminated following successful demonstrations has been rather discouraging.

In the last decade, a number of management tools to enhance the environmental performance of companies have been developed, or at least matured, and disseminated in industry. These include *eco-audits, environmental management systems, environmental reporting and life-cycle assessment*. As of today, it can be observed that these tools have been introduced as voluntary industry approaches. However, there is growing interest in exploring how such tools can be incorporated into governmental policy-making. Ireland's implementation of the IPPC Directive is in an interesting way to incorporate mandatory EMS and reporting requirements. In the summer of 2000, Denmark presented a system of environmental charges for packaging materials based on a life-cycle assessment model for such materials. Further introduction of these tools into government policy measures, voluntary as well as mandatory, can be expected. Adopting international standards for EMS and LCA facilitates inclusion of these tools in various regulations and incentive-based directives.

Eco-labelling was introduced in Germany over two decades ago. During the last decade, eco-labelling schemes have spread to a number of countries in most parts of the world. Systems exist in all types of economies. However, the real success of these schemes is limited to a few countries, mainly in Northern Europe. In most other countries the existing systems are experiencing considerable problems getting established and are sometimes ignored by the main clients, that is, the producers of the products to be labelled. In India, only single manufacturers have shown interest in the national eco-labelling system and such labels are, in practice, non-existent. Sweden has had the opposite experience. It is difficult to get some products on the shelves of shops if they are not labelled with either the common Nordic eco-label (the White Swan)[5] or the eco-label awarded by the Swedish Society for Nature Conservation. In a country like Sweden, it is evident that such eco-labelling can only marginally influence the country's total environmental burden. Stronger policy instruments are needed as a complement.

Various forms of *voluntary approaches* have attracted considerable attention in environmental policy discussions during recent years. Negotiated Environmental Agreements (NEAs) are a particular form of "co-regulatory" policy instruments, distinct from other co-regulatory instruments such as unilateral industry commitments and public voluntary programmes. NEAs (sometimes also known as industry "covenants") are agreements reached following a process of negotiation between two or more parties – with at least one party from the public sector and one from the business/industry community – that results in a commitment formally recognized by government authorities and subject to sanctions and/or positive incentives, with a view to achieving certain agreed objectives for improved environmental performance within the affected business or industry sector(s).

NEAs started to gain prominence during the early 1990s. They have been concluded throughout most OECD countries and increasingly in developing countries, particularly in Latin America. They have been used to address a range of policy issues, including product related concerns, pollution and energy efficiency targets, and reporting requirements. In the EU, the majority of NEAs relate to waste management or climate change issues. They are increasingly being introduced in developing countries. More experience is needed before solid conclusions can be drawn concerning the potential for voluntary approaches in various fields of environmental policy, as well as in various geographical, political and economical settings.

Just as the EU's IPPC Directive is an example of a comprehensive approach to regulating environmental impacts from production facilities, the *Integrated Product Policy (IPP)* concept is the new comprehensive approach to product-related environmental problems. It has been noted by governments of EU Member States, as well as by the European Commission, that it would be beneficial to coordinate the various policy interventions for a specific product range in a comprehensive policy framework. Without such an approach, there is a risk that instruments that contradict each other and provide unwanted synergistic effects will be introduced by governments. The IPP concept has been introduced into European policy discussions in the last couple of years. Its further development is still not clear.

Extended Producer Responsibility (EPR) is a policy principle for promoting total life-cycle environmental improvements of product systems through extending the responsibilities of the product manufacturer to various stages of the product's entire life cycle, especially to *take-back, recycling and final disposal*. Shifting responsibility for products' end-of-life management from consumers and authorities concerned with waste management to manufacturers (who can actually and most effectively change product characteristics) would make them aware of issues relating to end-of-life management of their products, including the cost involved. This feedback loop between downstream (waste management) and upstream (design of products) is the core of EPR. It is instrumental in improving the design of products and product systems, so that the environmental impact of a product is reduced during the entire life cycle.

Under an EPR programme, producers have responsibilities such as covering the cost of end-of-life management of their products (*financial* responsibility), being involved in the take-back of their products (*physical* responsibility), and informing waste managers of the content of their waste (*informative* responsibility). Types of responsibilities include: take-back of end-of-life products; establishment of take-back sites/infrastructure for products' end-of-life management; meeting recycling/recovery targets; environmentally sound treatment of end-of-life products; banning use of certain materials; and providing information on producer responsibility to consumers, on product content to treatment facilities, and on operations to authorities. Concrete means of meeting the responsibilities assigned to respective parties are often left up to the producers, as it is assumed they will do so in the most cost-effective manner.

EPR implementation will also encourage a shift towards providing the functions of products more efficiently. This could be the necessary push for a shift towards product-service systems. It will definitely enhance the interest in re-manufacturing activities in an industry that is manufacturing and providing complex products. An EPR system, with full responsibilities allocated to the original manufacturers, will make the business opportunities connected to such re-manufacturing and product-service approaches more visible and comprehensible for industrial entrepreneurs.

EPR can provide a financing solution for a government that wants to improve waste management and recycling standards. Contrary to the traditional means of financing such activities, EPR provides the possibility of not raising taxes and municipal charges. This is attractive, and relevant, in developing countries and economies in transition, as well as in OECD countries. Here is an explanation for the growing interest in EPR.

Finally, a number of governments have developed *national strategies or policy statements* relating to Cleaner Production, waste minimization and/or energy efficiency. Their role is to serve as a guiding framework for integrated development of policy instruments promoting preventive environmental management practices. In addition to various national and regional strategies, several governments have also signed the *UNEP International Declaration on Cleaner Production*, an international strategic policy statement for Cleaner Production.

Potential, opportunities and constraints

Implementation of policies, strategies and instruments will be decisive for the success of Cleaner Production. There is still a huge potential for pol-

icy interventions, as this is generally an undeveloped area in most countries. The necessary instruments and tools largely exist and are known to policy analysts. However, it will be necessary to form policy interventions in new ways so that preventive solutions to environmental problems receive the greatest support. Experience in creating efficient policies exists, but knowledge of successful experiences and of problems encountered ought to be disseminated in a better way.

Brave political decisions are required in order to implement mandatory policy instruments despite the lobbying of groups that oppose them. Lack of awareness of the urgency of making such decisions might explain the slow development observed in most cases, not least where international agreements are needed. The quest for economic development, and the interpretation of how free trade regimes should be developed in this context, risk alienating large groups of citizens from policy-makers and undermining confidence in international organizations. Mechanisms for approaching problems relating to products and services, which may have trade implications, must be developed, as evidence from several industrialized countries shows that the future challenge for policy-makers is to be found in these areas.

Voluntary approaches to forming policies in countries have attracted a lot of attention. They have been promoted as an efficient way to achieve environmental improvements. However, voluntary approaches must still demonstrate that they can replace mandatory regulations, and that they do not simply constitute the only alternative when more efficient approaches are blocked by decision-makers' lack of willingness to act.

Notes

1. See, for example, the special double issue of *Industry and Environment* devoted to voluntary initiatives (Vol. 21, No. 1-2, January-June 1998).
2. Swedish Ministry of the Environment (1991) *Hur mår Sverige? – en rapport om miljösituationen* (How Is Sweden Doing? – A report on the environmental situation). Bilaga A till regeringens proposition 1990/91:90. Stockholm: Miljödepartementet, p. 178.
3. The Nordic label is used in Denmark, Finland, Iceland, Norway and Sweden.

The author worked on the revision of UNEP's document on Government Strategies and Policies for Cleaner Production *in the spring and summer of 2000. This work was carried out together with Vladimir Dobes, Jonathon Hanks and Naoko Tojo, colleagues at the International Institute for Industrial Environmental Economics (IIIEE). The author is deeply indebted to them for much of the input to this article, in the form of ideas and facts, as well as texts describing particular instruments and examples of policy implementation.*

Japan's Specified Home Appliance Recycling (SHAR) Law

Manufacturers and importers of four categories of home appliances (large television sets, air conditioners, washing machines and refrigerators) are now required to take back discarded products they manufactured, dismantle them, and recover components and material that can be reused or recycled. Differentiated recycling rate requirements of 50-60% by weight are set for these products. The requirements should be met through product reuse, component reuse and material recycling with a positive monetary value. Environmentally sound treatment of printed circuit boards in TV sets is also required, under Japan's Waste Management Law.

Beginning in 2001, retailers (who had already been taking back approximately 80% of these appliances) are required by law to take back old products when they sell similar new ones, and to take back products they themselves have sold. Local governments will collect those products not covered by retailers. End-users are responsible for covering the costs of end-of-life management of the products they discard.

The SHAR Law, enacted in 1998 and fully enforceable in 2001, is the second EPR programme in Japan that legally assigns part of the responsibility for end-of-life product management to manufacturers. Scarcity of final disposal sites, increased amounts of electrical and electronic equipment (EEE) in the waste stream, and the inadequacy of existing treatment plants (managed by local governments) to handle EEE are the main driving forces behind this law's enactment.

This case study was compiled by Naoko Tojo, IIIEE, for the revised UNEP document on Government Strategies and Policies for Cleaner Production.

Policy and planning: a holistic approach to promoting Cleaner Production

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Over 50 organizations with international operations are currently spending many millions of dollars annually to promote Cleaner Production and related initiatives in Asia. Most national governments now fund their own Cleaner Production promotion programmes. The extent of concern over the impacts of industry and other economic activities on human health, and the sustainability of the environment and natural resources, is evident from the breadth of involved organizations. There is also a consensus, evident in the number of programmes specifically promoting Cleaner Production, that together with innovative and enforceable environmental standards and regulations, Cleaner Production is a key means to reduce pollution and conserve natural resources.

Yet the result of all this activity remains disappointing, and Cleaner Production practices are not spreading as rapidly as hoped, especially among small and medium enterprises. It appears that in the developing economies pollution and resource consumption intensities per unit of production are not falling as rapidly as total production is rising. Continuation of this pattern will mean that the rapid economic growth anticipated for the next decade in Asia and other newly industrializing areas will bring increasing risk to human health and continuing environmental deterioration and depletion of natural resources, and may well threaten collapse of urban infrastructure in many of the large, already stressed urban centres in the developing world.

Obstacles to rapid adoption of CP

There are many cultural and economic obstacles to rapid adoption of Cleaner Production. Even collectively, however, they do not seem to account for the slow spread of Cleaner Production practices considering the advantages they offer and the substantial expenditure of resources for promotion programmes. The Asian Development Bank (ADB) has observed in its work that two key conditions are generally missing and may account for these poor results. Most programmes to promote Cleaner Production have failed to address either:

- the underlying policy framework that could provide critical incentives for change; or
- the integrated national planning needed to focus actions and utilize resources efficiently in order to achieve the rapid spread of Cleaner Production.

These programmes consist of collections of useful actions to build capacity and awareness, but they have usually been selected episodically, without reference to any overall perspective of national goals or the conditions required to achieve widespread voluntary change.

The attention of both international donors and the many local organizations and governments with which they cooperate in promoting Cleaner Production has been directed almost exclusively to business itself, largely ignoring the important roles of both government and civil society in bringing about change. Their approach has been based on the belief that if information, skills and financing are made available, and industry leaders are shown directly how Cleaner Production can help them, many firms will soon seek the available resources and emulate the leaders. In a fully rational world, and with perfect access to information, that might work. But those conditions are not found in either the industrialized countries or the developing world.

Moreover, experience in many demonstration programmes has shown that if they have a free choice, businesses usually prefer to use resources to expand production and sales rather than to increase efficiency even when the latter clearly offers a greater net profit. This appears to be a fundamental orientation of business around the globe. In many situations firms have been observed to change location to escape regulatory and community pressures, even when increased efficiency through Cleaner Production offered a more profitable solution. This behaviour may seem completely irrational, and as such it points up a fundamental issue that has seldom been addressed in the last decade of efforts to promote CP.

The challenge is to change the perspective and behaviour of decision-makers. To do so, one must alter the conditions in which they make their decisions, including the array of rewards and penalties they confront from government, the technical and managerial resources available to them, and pressures that may be exerted on them by civil society. Only from a holistic perspective can one hope to choose the most effective set of initiatives from the limited available resources. Without strategic planning it is almost impossible to develop a holistic view, and without integrated action planning it is unlikely that the chosen objectives can be achieved with the limited resources available.

Most programmes to promote Cleaner Production have failed to address the underlying policy framework and the integrated national planning needed to use resources efficiently and to achieve the rapid spread of Cleaner Production. Even where public policy development has been part of a promotion programme, it has been seen as secondary to information, training and demonstration. Moreover, deeply ingrained bureaucratic territoriality and an exaggerated sense of sovereign prerogative have been a formidable barrier to any efforts, domestic or foreign, to suggest how public policy can be used to further the cause of CP.

Governments of developing economies are focused on economic growth. They generally have not seen Cleaner Production or related concepts as a national policy issue. While they see protecting the environment and public health, industrial growth, and promoting trade and investment as policy issues, and have established corresponding policy agendas, they tend to regard Cleaner Production as a technical solution to be addressed by business, not by government. Consequently, environmental policies remain inconsistent with industrial development and investment promotion policies, and CP concepts have not been mainstreamed in the public policies of the many aspects of economic activity that impact the environment and natural resource base.

Much of the enormous collective effort to reduce industrial pollution and promote Cleaner Production in Asia has focused on one or more of an array

of specific initiatives, from market-based instruments to plant demonstrations, from greening the supply chain to access to financing, and on to a long list of worthwhile but narrowly and exclusively business focused solutions. In the wake of the failures of planned economies, the concepts of planning have fallen out of favour. Few countries have attempted comprehensive planning for the promotion of Cleaner Production. Most donor and national programmes have therefore failed to address the issues from a holistic view of the problem, or to choose their initiatives strategically to achieve a broad and clearly articulated goal. Instead, national programmes are collections of intuitively selected actions, often reflecting individual local agendas and the perspectives of various donors. Without the national strategic planning that could focus and orchestrate available resources, and the mainstreaming of CP concepts and objectives into the policy agendas of the many relevant sectors of government and the economy, there has been little basis to expect widespread adoption of CP.

Guidelines on use of public policy and stategic and action planning to promote CP

The Asian Development Bank, in recent work to assist selected member nations directly in the formulation of policy agendas and strategic and action plans for promotion of Cleaner Production, has observed that in many sectors use of policy instruments to promote Cleaner Production, and the integration of Cleaner Production concepts in policy agendas, is often not well understood. Moreover, basic concepts of strategic planning and action planning have been overlooked or poorly understood, with the result that efforts to plan for the promotion of Cleaner Production often lack defined objectives and any clear strategy of how to achieve objectives or how to measure progress.

The ADB, in collaboration with UNEP, UNIDO, the United States-Asia Environmental Programme and the Asia-Pacific Roundtable for Cleaner Production, has therefore undertaken to develop and publish a handbook of guidelines on using public policy and strategic and action planning to promote Cleaner Production. The purpose of this publication is to give policy makers and policy influencers a practical set of guidelines for use of policy instruments and planning tools, so that they can guide government and civil society to a proactive role in achieving the most rapid introduction of Cleaner Production possible with the available resources.

The guidelines give a brief introduction to Cleaner Production, what it means, and its importance, especially to rapidly industrializing economies. They do not attempt to explain in detail how to implement CP. They assume that the reader is a policy maker or influencer rather than a technician, is already at least interested in doing something to cause CP principles to be adopted, and would like to understand how the government and the many other stakeholders can take an active role and what tools are available.

The guidelines address how to find more resources through inclusion of stakeholders that are often overlooked with regard to CP, thereby also spreading Cleaner Production into other areas of economic activity. Many assume that CP applies only to manufacturing or industry and resist applying the principles in other sectors. However, the principles of Cleaner Production are increasingly being applied in the way any organized activity sources its inputs and produces and delivers products or services. Examples in business include agriculture, transportation, tourism, energy, medical services, banking, education and many more, and governments at all levels can apply CP in the way they operate their facilities and deliver services to their citizens.

The guidelines explain the importance of including a broad spectrum of stakeholders in the planning process, both in order to spread concepts and practice of CP to these sectors, and to identify common interests and the resources that these other sectors may be able to make available to a national collaborative effort to promote CP. They discuss how to identify all stakeholders, and the importance of including them at all levels of decision-making. It is essential that a national plan be more than a government plan, and that the many stakeholders see themselves as valuable peers in the planning process and in its implementation.

It is also pointed out that for CP to become entrenched in any sector, the relevant principles must be incorporated into the public policy agenda that guides the sector. As a creator of policy, it is here that government must play a critical proactive role. That role can be at any level, from the highest national body to the smallest community council.

On a more tactical level, the guidelines review the many policy tools that have been used to promote CP and suggest some new ideas. The tools are presented in menus according to five basic categories: regulatory, economic/financial, information/education, voluntary programmes and transparency. Each tool's type of application is described, as well as the key ministries (environment, industry and finance) that might find it most useful. Finally, examples of policy agendas are suggested for key ministries to illustrate how the tools might best be used in combination. Recognizing that any actual selection will be different for every economy and culture, the guidelines attempt to provide useful examples that can help the policy maker unfamiliar with the subject make the transition from the theoretical to the tangible.

The guidelines are intended to be a practical tool to encourage and help policy makers to build a proactive role for government through creating conditions in which private sector decision-makers and operating elements of government will all see Cleaner Production as in their best interest. Publishing these guidelines, however, is only a small part of the difficult job of engineering change. While each of those who collaborated producing the guidelines will surely promote their use, a larger consensus is needed among donors and government leaders that Cleaner Production is a key to sustainable development, and that it requires an active role by government through strategic planning and policy integration.

A new paradigm is needed in respect to the way we all approach the promotion of Cleaner Production. Donors and national leaders should communicate ideas among themselves and seek ways to collaborate to achieve greater results. Moreover, a dynamic voice is required in each region to press for active national policies, and to be the teacher and transfer point of experience within a region and globally. This role is perhaps best carried out by regional roundtables, such as the Asia-Pacific Round Table for Cleaner Production. However it is done, active policy and planning roles for government remain the keys and necessary conditions if sustainable development is to be achieved through Cleaner Production.

National centres: delivering Cleaner Production

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Summary

With five years of experience behind it, UNIDO recently carried out assessments of a number of projects and centres with respect to their effectiveness as CP delivery mechanisms. The activities of six of the mature centres in the UNIDO/UNEP NCPC network (Brazil, China, the Czech Republic, Hungary, Mexico and Slovakia) were evaluated, as were some CP demonstration projects.

Résumé

Fort de ses cinq années d'expérience, l'ONUDI a récemment évalué l'efficacité de certains projets et centres pour la diffusion de la production plus propre. A cet effet, il a analysé les activités de six Centres nationaux de production plus propre du réseau conjoint de l'ONUDI et du PNUE (NCPC) parmi les mieux rodés (Brésil, Chine, République tchèque, Hongrie, Mexique et Slovaquie). Il a également mis au point quelques projets de démonstration du principe de production plus propre.

Resumen

Respaldado por cinco años de experiencia, Unido recientemente evaluó diversos proyectos y centros para determinar su efectividad como dispositivos de distribución de CP. Se evaluaron las actividades de los centros más desarrollados de la red UNIDO/UNEP NCP (Brasil, China, República Checa, Hungría, México y Eslovaquia), y algunos modelos de demostración de CP.

The UN Industrial Development Organization (UNIDO) and UNEP established the National Cleaner Production Centres (NCPC) Programme in 1994. Since then, with UNEP's assistance, UNIDO has established 19 centres in developing countries and countries with transition economies in Africa, Asia, Europe and Latin America.[1] A sector-specific Cleaner Production centre was created in Russia in 1999, focusing on the oil and gas industry. UNIDO has undertaken CP projects in India, Uzbekistan, Croatia and Macedonia. It is possible that centres will be established in some of these countries at a later date.

The basic premise of the NCPC Programme is that CP can only be sustained in a country if the capacity is in place for its adoption. Understanding and application of CP cannot come about unless the concept is promoted by professionals in the beneficiary country itself and adjusted by them to local conditions. Building the capacity to do this is the programme's main objective.

The NCPC Programme primarily targets the transfer of know-how rather than of technology. Centres, and the CP assessors they have trained, do not deliver ready-made solutions. Instead, they train and advise their clients on how to find the best solutions to specific problems.During the three to five years it takes for UNIDO to fully establish its centres, this capacity-building role is carried out by offering six basic services:

- awareness-raising;
- training;
- technical assistance;
- assistance in obtaining investments for cleaner technologies;
- dissemination of technical information; and
- policy advice.

As the NCPCs mature, they modify their menu of services to fit local conditions and to maximize their financial sustainability once they are independent of UNIDO oversight. In order to maximize the success of the transition to self-sustainability, UNIDO has its centres prepare and periodically update a business plan. To date, six NCPCs – in Brazil, China, the Czech Republic, India, Mexico and the United Republic of Tanzania – have successfully made this transition to independence. A seventh, in Zimbabwe, is well on its way to achieving financial stability.

Other centres have been established in the same regions by USAID, the World Environment Council and the Swiss State Secretariat for Economic Affairs (SECO). In a recent trend, countries themselves have established centres. The new Cleaner Production centre in Chile is an example. While generally quite similar to NCPCs, these centres can differ in some significant aspects, notably regarding the importance given to technology transfer rather than transfer of know-how.

Centres' potential to deliver CP

An important part of the work undertaken by the UNIDO/UNEP network of NCPCs (and other such centres) is promoting the use of methodological tools to help users systematically identify and assess the CP options available to them. Enterprises are the primary target users, but other groups are also targeted. It has been shown that when enterprises use these assessment methodologies they lead to economic as well as environmental benefits – the basis of CP.

The work of the NCPCs has also confirmed that, despite its evident economic benefits, application of the CP concept by small and medium-sized enterprises (SMEs) – the NCPCs' core client base – does not occur easily on economic merit alone. There is a need for a mechanism in these countries that deliberately and continuously supports SMEs' efforts to adopt CP. The potential clearly exists for national centres to be this mechanism.

Opportunities to act as CP delivery mechanisms

Demonstration projects and other awareness-raising activities, together with training, have historically been the most important of the six basic services NCPCs now offer. The reason lies in the thinking behind the original planning of the programme. It was believed that one major reason SMEs did not take advantage of CP's obvious benefits was that they were simply unaware of the concept and its advantages. Therefore, awareness-raising activities, especially demonstration projects, were considered a major opportunity for NCPCs.

It was also believed that this unawareness was to some extent due to the fact that methodological tools that could assist SMEs identify and assess CP options were not available to them. Training was therefore considered a second important opportunity. Finally, recognizing that environmental policies (laws and regulations), if not crafted properly, could discourage enterprises from adopting CP (or at least not encourage them as much as they potentially might), policy advice was considered another, although less important, opportunity.

With more experience, it was recognized that other opportunities were available to centres. First, they should attempt to offer advice on policies that were not "environmental" (i.e. prepared and implemented by an environmental agency). For instance, government policies to subsidize energy and raw material costs are an obvious disincentive

to CP, as they reduce the costs of inputs. This field is in flux, as more attention is devoted to better understanding the full range of public policies that could affect enterprises' CP decisions. As centres have built up their expertise and become known by industry as centres of excellence for CP, individual enterprises have come to them for help, increasing the opportunities to offer technical assistance and information. This has also become an important way for centres to ensure their own financial sustainability.

More recently, it has been recognized that enterprises' inability to raise money for needed investments in CP is a major barrier to adoption of cleaner technologies, especially by SMEs. At the policy level, attention is now being given to mechanisms to help finance CP investments.

Another trend that has become noticeable over the years is that NCPCs have begun offering services, including those involving environmental management systems (EMS) such as ISO 14001, energy efficiency programmes and life-cycle analysis, that go beyond the centres' original scope. This has proved so useful that all new centres are being trained from the start in EMS. A few centres are exploring the possibility of linking CP with quality systems and health and safety management systems.

Constraints faced by centres

Over the last year, with five years of activity now behind it, UNIDO has reviewed projects and centres to assess their successes and failures. An evaluation of the activities of six of the more mature centres in the NCPC network (Brazil, China, the Czech Republic, Hungary, Mexico and Slovakia) has been carried out,[2] supplemented by two UNIDO evaluations of CP demonstration projects.[3,4] While there is still room for more in-depth evaluations, some preliminary conclusions can be drawn.

The need to ensure financial self-sustainability

One of the most important constraints on NCPCs is the need to quickly become financially self-sustainable. Most donors will not fund a centre for over five years, and often not more than three. The NCPCs have a small "window of opportunity" in which to create a sufficient market for themselves, and this is hard. In at least one case where donor funding did not continue after an initial three-year period, a centre came close to collapsing. It was only saved by being appended to a broader CP project in that country, which was funded bilaterally.

Experience teaches us that developing a CP "culture" is slow in countries with economies in transition, and still slower in developing countries. It takes time to build up the critical mass of hands-on experience and "success stories" necessary to give centres the credibility they need with respect to managers of SMEs on one hand and government officials (or other potential clients) on the other. A market for CP services can only be created slowly. It may never be large enough to cover all the centre's costs. Certainly it will not cover activities that are not commercially interesting, even if they are useful for promoting CP.

Centres need to tap into other sources of funding. Programmatic support funds provided by local stakeholders are one possibility. Such funds already exist, mainly as in-kind support, but this source is quite modest and unlikely to grow. Funds from other international donors, in the form of projects on CP or related topics, are the other potential source. Centres are following up quite successfully on this source.

The net result is that mature centres (those no longer receiving funding from UNIDO) often cannot undertake all the activities they consider necessary to continue promoting CP at an adequate level of intensity. They tend to shy away from activities that are good for the country but not marketable. This can make them less a national institution for CP promotion, and more simply a consulting company. Centres also tend to look for other marketable opportunities in related fields, such as environmental management systems. This can actually be a very positive development, since the best way to promote CP is to promote the CP philosophy in as many different contexts as possible. However, there is an increased risk that, under constant pressure to survive, centres will eventually drift off into services that have little if any real connection with CP.

A second important constraint is linked to the self-sustainability issue. The centres' primary aim is to develop the local ownership and capacity necessary to promote CP, without which CP adoption cannot become sustainable. But this goal threatens to undermine the parallel pursuit of financial self-sufficiency. Local ownership requires centres to "give away" to other parties in the country the knowledge and skills they have gained in the CP area. Financial self-sufficiency pushes them to do the opposite, hoarding their knowledge and skills so as to make themselves more marketable. Examples of the tension between these two goals are already being reported by the mature centres, which find themselves in competition with consultants who have been trained by them.

Quite how to "square the circle" in this case is not absolutely clear. The general consensus is that this can only be done if centres take it upon themselves to stay at the cutting edge of the discipline, one step ahead of the competition, supported by their stakeholders. Many mature centres are already doing this. Their entry into new services related to CP is surely due, at least in part, to the desire to remain at the front. For this to work, however, centres need to be part of a good network that keeps them abreast, rapidly and efficiently, of the latest trends. The current UNIDO/UNEP network is not really designed to do that. There is also the danger that, in their search for competitive advantage, centres will shift their focus to areas with little if anything to do with CP.

Limitations of centres' activities

In general, centres have succeeded with the projects that were designed to establish them. Nevertheless, they have faced certain limitations.

Demonstration projects

Demonstration projects undertaken by centres are considered very important to industry's acceptance of the CP concept. Simply put, enterprises will not believe until they actually see CP in action. It would therefore be expected that enterprises participating in demonstration projects would continue with CP after the projects were completed, and that other enterprises would be convinced to adopt CP by the results.

Two recent studies suggest that results have been mixed.[3,4] While at least some enterprises directly involved in demonstration projects have continued with their CP activities after the projects ended, others have *not*. This could partly result from the fact that demonstration projects were not carried out in the context of a Cleaner Production centre that could continue pushing the enterprises when the projects were over. However, even more important is a very fundamental, unavoidable constraint in the concept of Cleaner Production centres, which can only put the necessary tools in the hands of those who will actually implement CP. The centres do not implement CP themselves. As the saying goes, "You can bring a horse to water but you cannot make it drink". Many other factors, in addition to lack of awareness or lack of tools, determine whether an enterprise will make a long-term commitment to CP. A not insignificant failure factor is therefore to be expected.

It appears that demonstration projects have had limited success in persuading non-involved enterprises to begin CP activities on their own. Success seems to have been greater where these projects left, as a "residue", a "champion" for CP (e.g. leaders of the Waste Minimization Circles in India, the municipalities involved in municipal-based CP assessments in Central Europe). These "champions" could perform the task of persuading and cajoling companies to continue down the CP path.

The value of demonstration projects is not only in their demonstration value *per se*. They also give centres and their core external consultants training on the practical application of CP concepts, as well as the promotional material needed to market themselves and their services to enterprises. By carrying out demonstration projects, centres bring about real quantifiable benefits: financial benefits for the enterprises taking part, and benefits for the environment as a whole. Valid as these benefits are, demonstration projects must effectively respond to their core requirement, which is to demonstrate to enterprises the value of adopting CP. If they do not, then some rethinking is needed.

Training

The situation is unclear with respect to the final value of the training given. In the past, centres' training activities were focused on company personnel taking part in the demonstration projects, and on external consultants who could then take part in in-plant assessments or offer other CP services. The fact that some enterprises participating in demonstration projects continued with CP activities shows that at least some of the trained

company staff used their training, so that long-term value was delivered. However, there is a strong element of chance concerning whether an enterprise will continue down the CP path. To some extent, centres can only launch enterprises down that path and then hope for the best.

The limited evidence available seems to show that consultants trained by centres as CP assessors have not had their services requested by companies to any great extent. This suggests that centres may be "putting the cart before the horse", creating a body of trained individuals ready to offer services for which there is as yet no market.

Policy advice

With respect to policy advice, the same uncertainty reigns as to the value of what centres have managed to do. Some of the mature centres have had a clear impact on CP policy. Others have been players in developing CP policies, but whether their input was in any way determining is unclear. Yet others have done little.

The most important factor seems to be that the more successful centres have obtained access to the highest levels of government. Here centres face a constraint that comes from another basic premise, adopted at the beginning of the programme. It has always been argued – quite correctly in the author's opinion – that centres would not successfully reach their prime audience, industry, if they were part of (or seen to be part of) the government establishment. Much care has always been given to choosing host institutions that were clearly "pro-industry", like industry associations or chambers of commerce, or at least neutral but sympathetic parties, such as technical universities. However, a strategy that keeps government out of the centres also keeps the centres out of government. It has therefore been more difficult for centres to make the necessary contacts inside the government so as to play the role of policy advisor.

An attempt was made, in the case of the first centres to lessen this separation, by including government representatives on their governing bodies. How successful this has been is open to question. In the centres that have been most successful, it does not seem to have been only this formal link between the centre and government that created the conditions necessary to make them accepted partners in the CP or wider environmental policy dialogue.

In the mind of this author, the centres' role in imparting policy advice is very critical. If CP is to be a long-term strategy in any country, it is vital to ensure that business conditions are modified through the policy-making process to push enterprises as a whole towards CP.

Technical assistance

As a natural follow-up to demonstration projects, and as a means of becoming financially self-sustainable, the mature centres have moved into consultancy-type activities, providing individual enterprises technical assistance to solve CP and related problems. This trend was not an explicit part of the structure of the projects run by UNIDO. However, UNIDO welcome it as a beneficial course for centres to embark on, so as to make them a more effective mechanism for delivering CP and to give them a broader funding base.

In general, this trend has been very positive although several major constraints hamper NCPCs from becoming truly dynamic mechanisms for delivering CP. First, there was great insistence from the start on the fact that centres, as capacity-builders, transfer know-how and not technologies, and that they put others in the condition to implement CP and do not implement it themselves. This has naturally meant that centres have heavily favoured building methodological capacity, with the idea that once the practitioners were given the right methodology they would naturally favour CP in their work.

The use of assessment and evaluation methods specific to CP does allow the users to "see" the activities under observation in a different light, and therefore to "see" CP options that had not registered with them before. The great mass of so-called "low-hanging fruit" (CP options that are quick and cheap to implement) identified in project after project is surely testimony to this fact. Yet once this transfer of know-how occurs, long-term shifts to CP by industry in any country will require enterprises to transfer, adapt or adopt cleaner technology. Centres' long-term success as CP delivery mechanisms will be a function of their ability to promote this process.

From that angle, it does not appear that the centres have had much of an impact so far. In one study, out of some 440 CP options identified during one year by six of the mature centres as part of their plant-level work, 50% were housekeeping measures and 18% were input material changes or better process control, neither requiring much if any investment. Of options actually implemented (64% of those identified), 58% fell into the category of housekeeping measures, with a further 16% in the categories of input material change and better process control. Only 21% of the identified options fell into "hard" technology options (equipment/hardware modification/replacement and change of process technology), and only 16% of the implemented options fell into these two categories.[2]

Since NCPCs are national centres, they are expected to be open to all industries established in the country. This would be the preferred method, since the centres have small staffs. Even in the best of circumstances they could only build up expertise in one or two industrial sectors, as some have indeed done. Centres thus tend to focus on methodological approaches that are valid for all industrial sectors, rather than fostering sector-specific expertise. Yet a centre's ability to tap into such expertise is crucial if it is to promote technology transfer, adaptation and adoption.

The relative lack of emphasis on promoting technological change is not solely due to a bias in the centres' "culture". One major constraint faced by enterprises in many countries is their limited access to affordable financing for the adoption of cleaner technologies. Another is a risk aversion phenomenon common to all enterprises all over the world. In neither case can centres currently have much leverage. However, these constraints do tend to reinforce centres' natural predisposition not to focus on technological change.

Being spread too thin

A major problem for centres is that they risk being spread too thin. Much is asked of them, and they are given relatively few resources. The idea has always been that centres would get around this problem through being a catalyzing agent and galvanizing other actors into working on CP. Nevertheless, particularly in larger countries like India and China, even this is much to ask of one small national centre. Furthermore, a centre works best as an industry support mechanism (surely its most important role) if it is close to its client base. This strongly supports having not one but many foci of CP scattered throughout a country's industrial fabric. That is already occurring in several countries, notably India, where a number of state level (and state funded) Cleaner Production centres are springing up, connected to the national centre through a series of training and other capacity-building links. In this context, it is interesting to note that in the United States, pollution prevention centres were created first at the state rather than national level.

The need for a network

In the last five years, a whole series of individual centres have been established. More are likely to be created in the future. Little has been done to link these centres in an overall network. Since they cannot draw efficiently upon each other's individual strengths and knowledge, they are not as efficacious as they could be. This is an issue on which centres have been pressing UNIDO, and one that UNIDO acknowledges. To date, lack of funding has made it impossible to implement a properly structured network.

Centres' relevance as CP delivery mechanisms

Up to now, the assumption has been that if centres offer their services efficiently and effectively, Cleaner Production will result. However, for NCPCs to be considered truly *relevant* mechanisms for delivering CP, they must show that their services bring about obvious environmental as well as economic benefits.

NCPCs have had an undoubted, documented *effect* through their various activities. Centres' awareness-raising and training activities have touched a wide range of persons and institutions in their countries, and have covered a good number of CP and related topics. The mature centres all have good records of demonstration projects undertaken, and the newer centres all have aggressive ongoing demonstration project programmes. There has also been some success in creating CP networks through involving other institutions within countries. Some centres have even been able to bring about quite significant policy changes that promote CP.

All these are means to an end. They are not the end itself, which is ever-growing adoption by industry of CP, leading to both environmental and

economic benefits. Here the picture is not so clear. Insufficient attention has been paid in the NCPC Programme to date to monitoring centres' impacts. Using a series of recently developed success indicators, all new centres are required to report annually not only on number of trainings, number of demonstration projects, etc. but also on their activities' impacts to the extent that these are measurable. More *post facto* evaluations of centres' work will help judge their true impacts, and thus their true relevance, as CP delivery mechanisms.

It is important to recognize that it will always be difficult to measure total impacts. By their very nature, the centres work mostly through others. Often other actors in countries where NCPCs are located are also attempting to exert influence in the CP area independently. Under the circumstances, it is difficult to say what outcome has been due to a centre. We may therefore have to be satisfied with obtaining only a partial response to the question of centres' impacts.

Notes

1. The United Republic of Tanzania (1995), Zimbabwe (1995), Tunisia (1996), Morocco (1999), Ethiopia (2000), Kenya (2000), Mozambique (2000), China (1995), India (1995), Viet Nam (1998), the Czech Republic (1994), Slovakia (1995), Hungary (1997), Brazil (1995), Mexico (1995), Costa Rica (1998), El Salvador (1998), Guatemala (1999) and Nicaragua (2000).
2. UN Industrial Development Organization (UNIDO) (1999) *In-Depth Evaluation of Selected UNIDO Activities on Development and Transfer of Technology. Component 1: The UNIDO/UNEP National Cleaner Production Centres (NCPCs)*. ODG/R.11. 27 October. Distribution restricted.
3. Van Berkel, R. (2000) *Assessment of the Impact of the DESIRE Project on the Uptake of Waste Minimization in Small Scale Industries in India*. Prepared for the Cleaner Production and Environmental Management Branch, UNIDO. February.
4. Sarmiento, F. (2000) *Assessment of the Impact of the E2P3 Project on the Uptake of Cleaner Production*. Prepared for the Cleaner Production and Environmental Management Branch, UNIDO. July (draft).

Cleaner Production worldwide: regional status

At CP6, representatives from 80 countries discussed Cleaner Production's status and future directions. Since CP5, held in Korea in 1998, substantial progress has been made in implementing Cleaner Production. Highlights include:

National Cleaner Production Centres

- UNEP/UNIDO Centres now total 19 (from 15);
- Institutions active in Cleaner Production number 331 (from 311) and are located in 75 countries.

UNEP-supported regional Cleaner Production initiatives:

- Second Cleaner Production Roundtable in the Mediterranean Region;
- First African Roundtable on Cleaner Production and Sustainable Consumption;
- Regional Cleaner Production Roundtable in Latin America and the Caribbean;
- Annual European Roundtable on Cleaner Production;
- Annual Asia and Pacific Cleaner Production Roundtable;
- International Pollution Prevention Summit.

UNEP publications:

- *Industry and Environment* review, issues specific to Cleaner Production:
- CP: 5th International High Level Seminar, Seoul
- Financial Services and Sustainability
- Sustainability and the Agri-food Industry
- Changing Consumption Patterns
- Cleaner Production Assessment Guides (meat, fish and dairy processing)
- Cleaner Production Newsletters No. 15-17
- *Cleaner Production: A Guide to Information Sources* (4th edition)

Towards a Global Use of Life Cycle Assessment

Cleaner Production progress was also reviewed at the regional and national level. During preparations for CP6, regional input was collected via roundtables and status reports, and through an on-line discussion forum. Four status reports were prepared outlining region-specific issues, international initiatives and updates on national progress. The four reports available are:

- "Status Report: Cleaner Production in Asia-Pacific";
- "First African Roundtable on Cleaner Production and Sustainable Consumption";
- "Cleaner Production in Latin America and the Caribbean";
- "Cleaner Production in the Mediterranean Region".

Each regional report was the result of a lot of hard work from the responsible national and regional organizations active in CP. Below is a brief summary of report highlights, beginning with a brief listing of regional activities under way. This is followed by a compilation of national statistics on CP progress.

Asia-Pacific Region

In addition to a variety of Cleaner Production activities initiated by international organizations such as the Asia-Pacific Economic Co-operation (APEC), the Association of Southeast Asian

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	Argentina	Bolivia	Brazil	Chile	Colombia	Costa Rica	Cuba	Ecuador	El Salvador
Undertaking demonstration projects with industry	xx	xx	xx	xx	xx	x	o	na	na
Providing technical information on CP options	xx	xx	xx	xx	xx	xx	xx	na	na
Providing information on CP assessment methodologies	xx	xx	xx	xx	xx	x	xx	na	na
Training on CP assessment methodology, conducting general CP	xx	xx	xx	x	xx	x	o	na	na
Training on raising public awareness about CP	o	o	o	x	xx	xx	o	na	na
Conducting CP policy studies or making CP policy recommendations	xx	x	o	xx	xx	o	xx	na	na
Development of CP technical materials	x	x	x	x	x	o	xx	na	na
Educating university or technical students about CP	x	x	xx	xx	x	o	o	na	na
Developing CP case studies	xx	x	x	x	x	o	x	na	na
CP centers	o	o	xx	x	x	xx	o	x	xx
CP financing	o	o	x	x	xx	x	o	x	x

xx: major activity
x: minor activity
o: not undertaken
na: not applicable

Nations (ASEAN), the Asian Productivity Organization (APO), the European Union, UNIDO and UNEP, three efforts stand out as crucial to boosting Cleaner Production:

- the establishment, and activities of, the Asia-Pacific Roundtable on Cleaner Production;
- the International Declaration on Cleaner Production;
- the Regional Technical Assistance (RETA) project undertaken by the Asia Development Bank.

The Cleaner Production Roundtable provides the first step for stakeholders to engage in discussion of CP. The Declaration solicits and solidifies commitment to Cleaner Production at the highest levels. And the RETA project supports the translation of commitment into action by conducting policy studies.

Summary highlights of national progress include:

- Of the 15 countries reviewed, *all* were noted as having undertaken some activities in the area of skill development, capacity building and information exchange. Examples include training of experts and trainers and development of country-specific case studies, demonstration projects or model business plans.
- Ten countries have established Cleaner Production centres. Three of these centres are hosted by UNIDO/ UNEP.
- Many countries have undertaken efforts to develop a policy framework conducive to Cleaner Production. Examples include specific national policies that stress Cleaner Production and prevention as the preferred environmental management strategy, drafted in India, Australia and China.
- Signatories to the International Declaration on Cleaner Production from 12 countries reflect high-level commitment.
- Involvement of different stakeholders, and mainstreaming of the concept, have taken place in different countries in different ways. India and New Zealand have developed networks of localized Waste Minimisation Circles for local entrepreneurs in small-scale industry. In Malaysia, a road show was developed to bring environmental management and CP to small-scale companies. New Zealand also has sector-specific Cleaner Production activities targeted at local authorities.
- Environmental management systems and international standards can be useful tools to leverage Cleaner Production integration. China, Japan and New Zealand have activities devoted to Cleaner Production and to ISO 14000. Australia and Korea have activities integrating Cleaner Production and life-cycle assessment, in recognition of the need to integrate Cleaner Production into product-related environmental management tools.
- Progress on financing CP has been made in several countries. Viet Nam is one of five countries involved in UNEP's Project on Financing Cleaner Production. China has worked with the World Bank and other donors to finance implementation of Cleaner Production, and Australia and Sri Lanka have set up independent revolving loan programmes.

African Region

In 2000, the First African Roundtable on Cleaner Production and Sustainable Consumption brought together Cleaner Production practitioners from 14 countries. Supported by UNEP, the Carl Duisberg Gesellschaft (Germany), and the Dutch and Norwegian Governments, it was the first regional event to also address sustainable consumption, recognizing the need to integrate both production and consumption elements in order to achieve more sustainable patterns.

- There are seven UNIDO/UNEP Cleaner Production Centres in the region.

Guatemala	Jamaica	Mexico	Nicaragua	Peru	Trinidad/ Tobago	Uruguay
xx	o	xx	xx	xx	x	na
xx	x	xx	xx	xx	xx	na
o	o	xx	xx	xx	x	na
o	o	xx	xx	o	na	na
x	x	o	o	xx	na	na
xx	o	o	o	xx	na	na
o	o	xx	xx	xx	na	na
o	o	x	x	xx	na	na
o	o	xx	xx	xx	na	na
xx	o	xx	xx	x	o	x
xx	o	x	xx	x	o	x

◆ The International Declaration on Cleaner Production has signatories from nine countries in the region, four of which come from national governments.
◆ Financing Cleaner Production has had some remarkable successes. The two pilot activities of the UNEP Cleaner Production Financing project are the most advanced in the project. Of the many loan proposals prepared, four have received funding and been implemented.
◆ Capacity building activities, including the training of trainers and country-specific case studies or demonstration projects, were undertaken in ten of twelve countries.
◆ Engaging all stakeholders, including small and medium-sized enterprises, in promoting Cleaner Production is a major challenge in the region. In South Africa, the issue has been addressed by waste minimization clubs that bring together companies to exchange ideas and information on waste minimization.

Latin America and the Caribbean

Regional activities have focused on bringing national experts together to exchange ideas and experiences. International seminars and events include:

◆ International Seminars on Cleaner Production hosted in Colombia (two) and Chile (one), with total participation from nine countries (Argentina, Brazil, Chile, Ecuador, Mexico, Costa Rica, Nicaragua, Venezuela and Colombia).
◆ UNEP/UNIDO Workshop of NCPCs from Mercosur countries (Southern Common Market).
◆ Two "Conferences of the Americas on Cleaner Production – Building the Roundtable for Cooperation in the Hemisphere" were hosted, one in Brazil and the other in Colombia.
◆ There are signatories to the International Declaration on Cleaner Production from seven countries in the region.

The chart summarizes country-specific information.

Mediterranean Region

The second Regional Report on Cleaner Production in the Mediterranean highlights international activities in this region as well as national Cleaner Production activities. The report, which covers some of the same countries as those in the African and European Regions, also presents information on problems common to Mediterranean countries. Some of the highlights are:
◆ Regional initiatives are supported by the Cleaner Production Regional Activity Centre in Barcelona, Spain, which acts as a focal point for information exchange and activities focusing on regional specific issues.
◆ Cleaner Production activities were identified in 13 of the 19 countries in the region.
◆ There are signatories to the International Declaration on Cleaner Production from four countries in the region.
◆ The report presents case studies that reflect industrial priorities and available Cleaner Production options.

Worldwide Cleaner Production Status

In preparation for the World Summit on Sustainable Development, to be held in South Africa in September 2002, a global status report on Cleaner Production will be prepared by UNEP. The report will highlight progress made since UNCED in 1992. It will spotlight successes and areas where more work needs to be done. The status report will cover Cleaner Production in terms of:
◆ policy framework (including integration into acts, regulations and policies, enforcement and permitting programmes, and voluntary agreements such as the International Declaration on Cleaner Production);
◆ skill development and capacity building (including training and education, demonstration projects, Cleaner Production centres, guidelines and manuals);
◆ information exchange (including databases, publications, awareness-raising seminars, case studies and technical guidelines);
◆ mainstreaming and stakeholder involvement (including different levels and types of stakeholders: government, industry, NGOs, academics and civil society);
◆ financing (including that of the above activities, as well as of options from Cleaner Production audits);
◆ integration into other existing environmental management tools (life-cycle assessment, EMS and standards, energy, health and safety, and sustainable consumption).

For more information, or to provide input to the global Cleaner Production status report, contact: Surya Chandak, Cleaner Production, UNEP DTIE, Paris (surya.chandak@unep.fr)

Using Cleaner Production to achieve implementation of MEAs

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Summary

The purpose of many global and regional MEAs is to achieve pollution reductions. Whether these MEAs contain general reduction requirements, or targets for reducing emissions or discharges of specific pollutants, Cleaner Production can help meet national commitments. To this end, the CP concept needs to be extended to effectively address sectors other than industry (e.g. agriculture and transport).

Résumé

De nombreux accords multilatéraux sur l'environnement ont pour objet de réduire la pollution. Qu'ils comportent des exigences générales de réduction ou des objectifs précis de réduction des émissions ou rejets de certains polluants, la production plus propre peut être une aide pour respecter les engagements pris au niveau national. Encore faut-il cesser de confiner le concept de production plus propre aux seules activités industrielles et l'élargir à d'autres secteurs (par exemple l'agriculture et les transports).

Resumen

El objetivo de numerosos MEAs globales y regionales es lograr reducir la polución. Ya sea que las MEAs presenten requisitos generales de reducción o metas de reducción de emisiones o descargas de contaminantes específicos, una Producción más Limpia puede ayudar a alcanzar los compromisos nacionales. A tal fin, es necesario extender eficazmente la difución del concepto de Producción más Limpia hacia sectores no industriales (por ejemplo: agricultura y transporte).

Only limited attempts have been made to use Cleaner Production systematically as an implementing tool to meet the commitments set out in global or regional multilateral environmental agreements. One problem is that the specificity of many MEAs does not leave much room for innovative solutions.

The traditional way to control emissions or discharges, as developed in the 1970s and 1980s, is with end-of-pipe solutions. In this case, governments impose very specific requirements based on their knowledge of best available technologies. Most early MEAs contained end-of-pipe requirements. Since limits were strict, industry had no choice but to invest in a limited number of technologies that would sufficiently reduce emissions or discharges of the pollutants in question. Effective promotion of those technologies, however, would make it difficult to develop other means of achieving the same goal.

Target industries resisted these requirements as long as possible, but they generally initiated early activities to develop the needed equipment. Small and medium-sized industries have always had a hard time meeting end-of-pipe requirements. Since they have lacked the resources to develop solutions themselves, they have been forced to buy expensive equipment developed and produced by larger industries.

More recent MEAs are increasingly open with respect to the way their requirements can be met. The introduction of economic instruments, as represented in the VOCs Protocol to the UNECE Convention on Long-Range Transboundary Air Pollution (LRTAP) or the UN Framework Convention on Climate Change (UNFCCC), is a significantly more flexible approach than the only-one-way-to-meet-the requirement approach relied upon earlier. Emission trading and joint implementation are examples of such economic instruments.

Economic instruments, however, are normally better at stimulating reduction processes than at meeting specific emission targets, when they are rarely effective. The importance of economic instruments has put an important focus on the costs of reductions, and on allowing industry to meet general or specific goals more flexibly. Taxes on toxic raw materials or hazardous wastes, and emission taxes, are other ways to stimulate industry to review total operations. The greater openness in MEAs to using economic instruments should stimulate more widespread use of the CP approach.

Total bans vs. pollutant reduction conventions

Pollution reduction conventions can broadly be divided into two groups: those whose goal is to *eliminate* emissions or discharges of specific substances, and those whose only purpose is to *reduce* these emissions or discharges. The Montreal Protocol, the new Convention on Persistent Organic Pollutants (POPs),[2] and parts of the Regional Seas Conventions all strive towards a zero emission goal. However, the Basel Convention on the Transboundary Movements of Hazardous Wastes, the LRTAP, the UNFCCC, and parts of the Regional Seas Conventions are aimed at reducing pollutant emissions or the production of hazardous wastes.

Cleaner Production programmes, if developed to assist the implementation of MEAs, would probably have to adopt different strategies depending on the purpose of the agreement. It is likely that CP strategies would be more successful in the case of MEAs designed to reduce pollutants.

The latest Conference of the Parties to the Basel Convention put greater emphasis on waste minimization, including reduction of the toxicity of the wastes produced. To implement the waste minimization focus, specific pilot projects, CP case studies and training curricula should be developed, where lacking, for the most important waste streams, involving several types of industries. In fact, this is a specific recommendation of the last Conference of the Parties.

The waste minimization requirement is a general obligation of the Parties. Many Parties tend not to put much emphasis on these general clauses, and the urgent need for general action is sometimes given significantly lower priority than fulfilling specific requirements. CP programmes would therefore have an additional task to perform: encouraging awareness of the need to make efforts to fulfil these general clauses of MEAs, as well as performing an educational role with respect to both industries and governments.

The LRTAP provides an example of the potential to use CP to achieve the goals of MEAs. In its latest Protocol, adopted in 1999,[3] the Parties have agreed a multi-effect and multi-pollutant strategy to deal with several types of emissions (SO_x, NO_x, NH_3 and VOCs) that can cause acidification, eutrofication and ground-level ozone formation. Using a critical load/critical level approach, each country has been given an emission ceiling based on the effect of its emissions on the targeted effects in other countries. There are emission limits for several major stationary and mobile sources. This approach is modelled on the traditional approach to curbing emissions. However, the Parties can

deviate from these requirements as long as they meet the emissions target by other means.

Regarding exchange of information and technologies, the Parties shall exchange information *inter alia* on the development and updating of databases of best available techniques, including those that increase energy efficiency, low-emission burners and good environmental practices in agriculture, as well as the development of less polluting transport. Measures shall also be developed to encourage introduction of low-polluting processes and products, management programmes to reduce emissions (including voluntary programmes), use of economic instruments, and removal of damaging subsidies, tax, fiscal incentives and duty exemptions which run counter to the Protocol's objective.

This Protocol, which is a sophisticated mixture of scientific understanding and policy response, opens up quite a large area for using CP approaches. There are alternatives to technical standards, provided that overall reductions of targeted substances could be achieved by other means. The Protocol also addresses the use of economic measures. It calls for the removal of economic subsidies that counteract the aim of the Protocol. This flexible approach might serve as a pilot example of how MEAs could achieve strong environmental results while taking full account of the different situations in different countries, different industrial structures, and the variety of measures already introduced.

MEAs with reduction purposes are still targeting specific pollutants, and therefore specific types of industries. Some of these pollutant sources may not be relevant to CP programmes in their present form, such as emissions of NO_x from vehicles, which in Europe and North America account for 50-60% of all NO_x emissions. Since both the latest LRTAP Protocol and the Kyoto Protocol require development of less polluting transport, a cleaner "production" programme may target the government in respect to this specific sector. The approach followed in the industry programmes may be developed into a total governing programme for the authorities, proposing a comprehensive approach to this sector.

Coal- or oil-fired power plants, which emit a significant portion of total NO_x emissions, are targeted by this LRTAP Protocol, as well as by the Kyoto Protocol, because of their emissions of CO_2 and N_2O. These power plants could also be targets for CP programmes. Indirectly, through other CP programmes in other types of industries where energy consumption is a target, this would have a positive effect through reducing demands for energy and lowering the need for energy production.

The Regional Seas Programme

The Global Programme of Action (GPA) is a structure adopted in 1995 as a comprehensive programme to protect and conserve the world's marine environment from the adverse impacts of land-based activities. The GPA is designed as a source of conceptual and practical guidance, to be drawn upon by national or regional authorities in devising and implementing sustained action to prevent, reduce, control or eliminate marine degradation from land-based activities. The GPA aims to integrate protection of the marine environment into relevant environmental, social and economic development policies.

Implementing the GPA is primarily the task of governments, in close cooperation with all stakeholders including local communities, public organizations and the private sector. The GPA identifies UNEP's Regional Seas Programme as an appropriate framework for delivery of the GPA at the regional level.[3]

The Regional Seas Programme was initiated by UNEP in 1974 as a global programme, implemented through regional components. Since then, UNEP's Governing Council has repeatedly endorsed a regional approach to the control of marine pollution and the management of marine and coastal resources. It has also requested the development of regional actions plans.

The UNEP Regional Seas Programme includes 13 regions. Over 140 coastal states and territories participate in it. In addition, there are three non-UNEP Regional Seas Programmes for the Arctic, the North-East Atlantic (OSPAR) and the Baltic Sea (HELCOM). All these action-oriented programmes are concerned not only with the consequences but also the causes of environmental degradation, encompassing comprehensive approaches to combating problems through sound management of marine and coastal areas. The action plans promote parallel development of regional legal framework agreements and of action-oriented programmes.

Means of implementing the Regional Seas Programmes vary according to the specific issues being addressed. The regulatory instruments used include traditional direct regulation and legislation through national and local laws, standards and emission permits. However, as an evolving instrument these programmes can also include economic and financial instruments such as taxes, subsidies, domestic funding and public/private partnerships. Structural/operational measures include both infrastructure projects, such as sewage treatment plants, land-use plans and upgrading of industrial machinery, and specific references to the use of CP/best practices, such as best management practices for environmental enhancement of industries (e.g. waste water reduction, energy efficiency).

The Regional Seas Programme has developed a structure of governmental and non-governmental organizations which provide the institutional mechanisms responsible for, and capable of, developing and implementing management programmes and plans. It also addresses capacity building, including training workshops, environmental education and conferences. Use is made of awareness raising and public participation, including NGO involvement.

Bearing in mind the variety of possible "targets" for CP activities and the large number of countries involved, as well as the Global Plan of Action (108 countries plus the EU), the Regional Seas Programme should be of major interest to most Cleaner Production centres.

The climate change challenge

Except in a few countries, the targets elaborated in the Kyoto Protocol would be difficult to meet. However, looking at other MEAs, there are possibilities to identify some activity areas, whether specific industries, transport, hazardous wastes or agriculture, where a targeted, broad-based programme like the Cleaner Production Programme could play a role. This may require some changes in today's approach, while adhering to the basic philosophy behind the CP work. The task is assisted by one of the annexes to the Kyoto Protocol, which lists the relevant sectors and source categories whose greenhouse gases should be controlled or reduced.

While the Kyoto Protocol put most of the burden on Annex I (industrialized) countries, the UNFCCC urges all countries to control their emissions and increase the GHG sinks, taking into account their common responsibilities. In any case, the obligations in the Kyoto Protocol could only be viewed as the start of a process. They are far from sufficient in themselves to deal with the climate change problem. The CP programmes in developing countries and in countries with economies in transition should, where relevant, emphasize pilot programmes that address GHG emissions.

Conclusion

The scope for using CP methods to achieve national commitments under MEAs has been clearly demonstrated. In some conventions, where reductions in emissions or discharges of individual pollutants are specified, establishing CP in a few key industries would significantly improve the situation. The potential for CP is highest when dealing with reduction targets, and less when the goal is to stop all emissions, as in the Montreal Protocol.

Today's CP concept needs to be broadened to effectively address sectors other than industry. Areas like agriculture and transport would benefit greatly from a comprehensive approach. The client would not be industry, but, for example, governments or farmers. If today's CP programmes were to encompass these groups, the market for CP centres would increase significantly. Most importantly, the environmental effects would go a long way towards meeting national commitments agreed in several MEAs, as well as creating a better environment.

It might be useful to arrange a specific meeting between the secretariats of relevant conventions and the UNEP/UNIDO Cleaner Production Programme, to identify common areas of action or areas in which CP programmes could support and facilitate implementation of specific conventions. The cooperation of UNEP's regional offices should also be reviewed. Conventions that have specific training activities, such as the Regional Training Centres under the Basel Convention, should where possible work closely with the Cleaner Production Programme, as specified in the work programme adopted in the last meeting of the Conference of the Parties.

Not many of the conventions have specific

training facilities. The Parties would normally be left alone to find ways and means to meet the general and specific obligations. CP centres should take this opportunity to offer assistance to national governments and, wherever possible, look for possibilities to assist governments in neighbouring states.

New and innovative ways to raise funds should be sought. MEAs could be one source of specific funding through the incorporation in their work programmes of specific references to the need for CP programmes. However, the budget constrains in the conventions are normally tight and there would be a need for additional funding outside the industries, governments and conventions secretariats.

Notes

1. The Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes. See *http://www.unece.org.env.*
2. See *http://www.chem.unep.ch/pops.*
3. The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone. See *http://www.unece.org.env.*
4. See *http://www.unep.org/unep.program/natres/water/regseas.htm.*

◆

How to finance Cleaner Production

Summary

Financing investments in Cleaner Production remains problematic, despite increasing awareness of CP's merits within the business community. Examples are given of initiatives and mechanisms that could overcome barriers to financing. It is in the interest of policy-makers and the business community to take measures geared towards integrating Cleaner Production into decision-making and management processes.

Résumé

Financer les investissements dans des modes de production plus propre reste problématique, malgré la prise de conscience croissante de leurs avantages par les entreprises. L'article donne des exemples d'initiatives et de mécanismes qui ont permis d'abolir les barrières au financement. Il est dans l'intérêt des responsables politiques et des entreprises de prendre des mesures pour intégrer la production plus propre dans le processus décisionnel et la gestion.

Resumen

Aún resulta difícil financiar inversiones en Producción más Limpia, a pesar de una creciente concientización respecto a las ventajas de Producción más Limpia en medios empresariales. Se presentan ejemplos de iniciativas y procedimientos que permitieron superar las barreras del financiamiento. Es de interés para los responsables de la elaboración de políticas y los medios empresariales tomar medidas que tiendan a integrar los principios de Producción más Limpia en los procesos de gestión y toma de decisiones

Developing countries and countries in transition have an opportunity to avoid the costly waste management solutions that have burdened the industrialized world. Whether countries seize this opportunity greatly depends on the types of technologies they choose to adopt for new and retrofit investments, and on the availability of appropriate financing.

Despite the advantages of the Cleaner Production strategy, mobilizing investment funds is a major constraint with respect to achieving wide adoption of CP. Financial institutions and other sources of private sector funding follow a well defined due diligence process when evaluating loan and investment proposals. The process consists of verifying the technical, financial and legal aspects of the project, evaluating the borrower's creditworthiness and assessing the different risks involved. Environmental risks are still often undervalued in this process, and many environmental management costs are hidden in companies' overhead accounts.

To understand the reasons for this, and to develop instruments to alleviate constraints, UNEP DTIE launched a project on "Strategies and Mechanisms for Promoting Cleaner Production Investments in Developing Countries", financed under a trust fund from Norway. As part of the project, it studied the experience of eight developing countries and countries in transition and reviewed how selected financial institutions in the developed world address environmental issues, particularly those related to CP. The countries studied were Guatemala, India, Lithuania, Mexico, Nicaragua, Tanzania, Viet Nam and Zimbabwe.

The *overarching conclusions of the study*, applicable to all pilot countries, can be grouped under three main headings: language, time scales, and size of investments.

Language

The level of response to the global survey was exceedingly low. "Cleaner Production" has not been embedded in the financial services industry in the same way as "environmental management". There is a lack of clear understanding of the CP concept, as well as misunderstandings or misinterpretations regarding its purpose. This language barrier was also observed at the national level, where there were clear differences in the "boundary conditions" for CP investment descriptions. Flexibility of interpretation is to be encouraged. It promotes innovation, extends the boundaries of environmental management to sustainable development policies and practices, and engages a wider level of societal input than would otherwise be the case.

Time scales

The process of initiating a CP assessment of a production process or potential design change is generally quite swift. Ensuing recommendations that require little capital investment are normally implemented quickly. However, in cases where the CP concept is integrated into the capital budgeting process, a much longer time frame is required. Empirical evidence confirms that the period between loan agreement and disbursement is a significant barrier.

Size of investments

The danger is that where the CP component of an investment is justified separately, it is seen as an additional rather than an integral part of the project. This has the consequence of isolating CP investment as a hybrid rather than treating it as a mainstream embedded issue. Clearly, the best results can be achieved if the process changes incorporating CP investment are valued as a whole.

Conclusions and recommendations

Each of the individual *country sections* of the report incorporates national conclusions, based on the CP project analysis and financial institutions review, together with relevant recommendations. Some interesting findings relevant to one or several of the studied countries are:

- In many developing countries, bank loans are considered unattractive due to high interest rates and unattractive terms for loans. Most companies require low-interest, long-term loans for environmental projects. Furthermore, the procedure for borrowing money from commercial banks is often considered complicated and costly.
- In many banks, the due diligence process mainly considers the financial aspect of loan applications without paying much heed to technical ones. However, some countries are gradually beginning to translate environmental considerations and sustainable development into financial markets. Although many financial institutions are familiar with environmental opportunities, environmental investments remain small. Forthcoming environmental funding programmes (e.g. the World Bank Carbon Fund) are seen as new opportunities.
- Current efforts to promote and implement CP mostly concentrate on developing and adapting technology to existing production plants. In the future, the focus will eventually involve "technological leaps" requiring fundamental changes in the production plant, composition of raw materials and intermediary products, product design, etc. As this transition takes place, the size and magnitude of CP projects will begin to reflect the change taking place. This will have significant implications with respect to financing requirements for industry.
- So far, government policies have focused mainly on tools for enforcing and extending compliance. The challenge for governments will be to create a framework providing incentives for companies to move beyond compliance and take up CP as an efficiency measure.
- Policies introduced in some countries have highlighted the importance of environmental technologies with tax breaks on importation and use of contamination-control equipment. Equally, the establishment of a similar programme focusing predominately on CP technologies could highlight advantages over end-of-pipe technologies.
- The ability to purchase appropriate machinery and equipment to support the CP concept has proven difficult for businesses to acquire.
- In some countries, the greatest potential for CP is the inflow of foreign direct investment (FDI), which can stimulate further new investment through downstream or upstream production. FDI can therefore contribute to capital formation and job creation.

The study highlighted some *key recommendations* for promoting adoption of Cleaner Production investments worldwide. These include the need for:

- governments to signal change regarding national strategies that embrace Cleaner Production;
- industry to take up the challenge of creating ongoing demand for Cleaner Production measures that will spur continued progress;
- educationalists to integrate such thinking into the formal education programme;
- the financial services sector to identify Cleaner Production as an investment opportunity through financial innovation.

The authors of the report believe the long-term goal will be to pursue introduction of Cleaner Production to every industry, as a way of triggering worldwide transformation of industrial practice and philosophy.

Stakeholders

Another survey carried out by UNEP DTIE in January-March 2000 collected data for a "who is who compendium in CP financing". It revealed that new initiatives are sprouting with respect to promoting investments in preventative approaches, waste minimization, Cleaner Production and related activities. In particular, this is happening in governmental and semi-governmental institutions. Some NGOs and consulting companies have also developed services addressing this issue. Financial institutions lag behind. Very few commercial banks perceive the Cleaner Production strategy adopted by a loan applicant to be a favourable criterion when approving funds or assessing risks.

The number of stakeholders in activities related to promotion of CP investment financing goes well beyond those customarily linked to the dialogue on CP itself. Instead of providing financing, some stakeholders have an important role in raising awareness, providing technical advice, disseminating information, training, etc. Potential stakeholders include:

- international financial institutions (private and public);
- multilateral financial institutions (World Bank, IFC, regional development banks, national development finance institutions in OECD countries, etc.);
- Export Credit Agencies;
- foundations;
- the media, in their roles as representatives of civil society and information disseminators;
- ministries of economy and finance;
- chambers of industry and other representatives of the business community;
- CP service providers; and
- academic and training institutions with financial analysis, business planning, accounting and engineering curricula.

Possible responses

The following *strategies and responses* could be considered for these important groups of stakeholders:

- increasing the capacity of public bodies to develop/foster environmental framework conditions (legislation, etc.) and their enforcement;
- increasing the capacity of technical assistance providers (CP centres, consulting companies, etc.) and CP assessors regarding preparation of creditworthy loan applications;
- improving awareness of new tools and instruments for assessment of CP options' economic merits by financial institutions in developing countries;
- increasing the capacity of decision-makers to integrate CP into their company strategies, so as to maximize internal rates of return on investments in production and infrastructure facilities;
- mainstreaming environmental investments into a bank's portfolio (adoption of CP as a viable investment field by loan officers);
- promotion of credit schemes customized to CP investments;
- active matchmaking between potential CP investors and credit lines, trust funds, etc. dedicated to pollution prevention or other environmentally sustainable projects and initiatives; and
- global networking and advocacy with respect to multinational financing institutions, to increase emphasis on the preventative approach in their commitment to (and implementation of) environmentally sustainable financing schemes.

Possible strategies and responses have been debated during various CP-related forums in recent years. CP financing has emerged as a topic at most of the CP regional roundtables held in Asia, Europe, the Americas and, most recently, the Mediterranean region and Africa. National CP roundtables have also introduced this element on their agendas.

Selected responses to date

The UNEP Financial Institutions Initiative on the Environment originated in 1992, when the "Statement by Banks on the Environment and Sustainable Development" was signed by some 30 banks following the Earth Summit. By August 2000, over 180 financial institutions were signatories. The Financial Institutions Initiative promotes integration of environmental considerations into all aspects of the operations and services of the financial sector or individual companies through building awareness, dialogue and understanding, and by fostering private sector investment in environmentally sound tech-

nologies and services.

The number of dedicated revolving funds and credit lines for CP investment has increased considerably in the last two years. Several activities by the World Bank, Asian Development Bank, Nordic Environment Finance Corporation (NEFCO), Inter-American Development Bank, EBRD, KfW of Germany and others have been launched or are being formulated.

While such activities are an effective way to promote adoption of the CP strategy in enterprises (combining CP assessments with the possibility of funding some of the required investments), the major challenge ahead is to mainstream and integrate CP into the due diligence process, company management strategies, government policies and university curricula. This paradigm means a shift in the responsibility for environmental management in an enterprise (including application of CP as a strategy) from environmental specialists to the CEO and the entire company management.

Definition of a Cleaner Production investment

An all-embracing definition of a Cleaner Production investment may not be possible, and perhaps will not even be necessary. However, it is important to arrive at a commonly accepted overall definition to ensure that different stakeholders speak the same language. Such a definition can also guide various institutions launching their own initiatives in establishing their own criteria for assessing what CP investment or new technology in general.

For the purpose of starting a dialogue with stakeholders, UNEP DTIE proposed the following definition in a background note prepared for a web discussion in August 2000:

A Cleaner Production investment is a management decision to invest in an industrial project, modification or upgrading (retrofit and new) which:

- reduces use of materials, water and energy;
- improves environmental performance;
- reduces risk liabilities;
- is not an additional cost related to environmental performance; and
- meets acceptable financial criteria.

This proposal has attracted several useful comments. For example, a detailed and focused definition from the Tellus Institute concerning a CP investment project reads as follows:

A CP investment is a potential business investment project that reduces the use of raw materials/natural resources (materials, water, energy), especially:

- hazardous/toxic materials;
- non-renewable and locally scarce resources;
- resources that are likely to have negative health and other impacts on humans and ecosystems during production or delivery;
- reduces or prevents waste generation/pollutant emissions at the source or via recycling/reuse (i.e. not via waste treatment or control);
- reduces or eliminates the potential health and other risks to humans and ecosystems of the waste or pollution generated;
- takes into account trade-offs among the above types of CP benefits.

A CP investment can include:

- the redesign of existing products and services;
- the modification/upgrade of existing equipment and processes;
- the acquisition of new equipment, processes and product lines.

A CP investment will often be profitable due to reduced raw materials purchase and processing, as well as waste management costs, and often has related business and financial benefits such as:

- increased production throughput and product quality;
- reduced liability and insurance costs; and
- improved company and product image.

When we talk about an investment (including CP), however, we should clearly distinguish it from a project. A project is something that someone wishes to invest in, but is not an investment until an investor actually decides to provide the funds. Also, if a project is funded by a donor who does not expect a financial reward or its money back, we are not talking about an investment in its terms or records.

The two approaches presented above will need to be combined into a lead statement, and possibly some more detailed selection criteria and qualifiers. In doing this, we should bear in mind that financial criteria are of paramount importance to financial institutions, which are the main stakeholders in the promotion of CP investments.

Language

There is a clear need to make the language for "Cleaner Production" clearer, and as embedded in the financial services industry as "environmental management". Multilateral financial institutions and the signatories to the UNEP Statement by Financial Institutions on the Environment and Sustainable Development can play an important role in leading this process. Many activities addressed under the headings below will also contribute. Participants at the CP6 parallel session have been encouraged to provide suggestions and ideas on how and through which forums to accelerate the process.

Integration/mainstreaming

A key to wider adoption of the CP strategy is its integration in overall company strategies, in the due diligence process for investment appraisal, and in the curricula of academic institutions educating process engineers, financial analysts and accountants. The UNEP DTIE project on "Strategies and Mechanisms for Promoting CP Investments in Developing Countries" is in the process of developing training courses which will, *inter alia*, include suggested tools and instruments for integrating CP into the due diligence process.

Engaging accountants

Within the framework of work carried out by the UN Division for Sustainable Development, a paper is being prepared by the Tellus Institute in Boston, with assistance from Joanneum Research in Austria, on policies for improving the role of government in promoting environmental managerial accounting (EMA). The paper will present case studies of past and ongoing EMA policy programmes and initiatives, discuss the challenges and successes of those programmes, identify policy pathways that may not yet have been tested, and make some general recommendations on next steps. A full draft of this policy paper was presented at an expert group meeting in Bonn in November 2000. The final version will be made available to the UN Committee on Sustainable Development in 2001.

The joint UNCTAD/UNEP project in the area of environmental accounting has outlined a governance structure within which the value of a CP investment may be properly described. This model has been accepted in a number of jurisdictions and should be further promoted by member governments. UNCTAD has also done considerable work on environmental performance indicators. This has catalyzed change in a number of areas of the financial services sector.

The UNEP/DTIE project on CP financing in developing countries is in the process of designing training programmes on CP as profitable investments and the CP investment process. These programme also target accountants and educational institutions training accountants.

The role of Export Credit Agencies

Export Credit Agencies (ECAs) are a very important source of project financing from developed to developing countries. They have begun a dialogue on how to consider environmental aspects in their operations with other partners, such as the OECD and multinational financial institutions.

The role of bodies controlling stock exchange listing requirements

Experience shows that in developing countries and economies in transition the pre-privatization phase is the time frame in which there is the greatest opportunity to influence future investment patterns. The bodies controlling stock exchange listing requirements have an influential role that can be brought to bear for the benefit of CP investments. For example, Thailand's stock exchange already requires all companies seeking a listing to report explicitly on their environmental impacts and environment improvement programmes. Introducing similar pre-qualifications will raise awareness of the different investment profiles of companies that embrace CP technology and those that do not. For indigenous stock exchanges, this may provide an opportunity to float more secure, lower-risk, and more long-term focused investments. It improves the stability and reduces volatility of a stock exchange's listed companies.

Policies and incentives

Governments can introduce policies and instruments (import tax reductions, special funds and credit windows for CP, pricing of water and energy, etc.) that promote CP solutions in the selection of technology for retrofits and new

investment. Policies that prevent pollution tend to be more effective and cheaper in the long term than those inducing the treatment and disposal of wastes that could be avoided. The development and enforcement of such policies will require participation of a number of ministries and agencies, such as ministries of finance, customs and tax departments, investment promotion and licensing authorities, and industrial promotion and control agencies.

At the international level, mechanisms to transfer intellectual property rights to developing country agents are needed to stimulate local production and commercialization of CP. Such mechanisms need not be complicated inter-governmental constructions, but may instead rely on private arrangements such as multinational joint ventures. Developing country agents can also make greater use of pollution prevention trade promotion tools to support investment in CP. This could include proactive use of eco-labelling and participation in international standards programmes (e.g. ISO 14000).

Also at the international policy level, developed countries need to eliminate escalating tariffs that prevent developing countries from moving up the production chain away from raw materials and commodities towards products with substantial added value. This would allow developing country agents to internalize environmental costs into export production.

Efficiency in enterprises can be improved through adoption of a Cleaner Production strategy. Efforts should be made to link CP with quality and environmental management systems. A major step forward would be to have a CP approach as a potential component of a formal EMS system. One avenue might be to review how CP could be integrated into any revision or extension of ISO14001.

Reducing risks to financial funding agencies

Often, financially sound CP investment proposals present obstacles related to risks (size or location of a project, other unpredictables). In order to enable banks to take decisions on regular commercial terms, mechanisms such as partial guarantees, revolving funds or soft loans may be established to bridge the gaps.

Broadening the number of stakeholders

The section on stakeholders above provides a suggested list that may require expansion or revision. Which stakeholder groups should be targeted, so as to achieve the most effective response and rapid adoption of the preventative strategy in making decisions to finance investments in production and service facilities?

CP investments and the economy

The contribution of CP investments to the economy at the micro and macro levels has been studied very little. As this is a very interesting and challenging area of work, future High-level Seminars on Cleaner Production may wish to call upon relevant international and national economic research and statistical institutions, and ministries, to initiate research activities targeting these issues.

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Technology innovations and Cleaner Production: possibilities and limitations

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Summary
A wide range of technologies and related research disciplines can contribute to Cleaner Production. Technologies based on life sciences and biotechnology will play an increasing role in moving global production systems towards sustainability. As a driver, scientific and technological advances are insufficient to achieve adoption of CP by industry. Market forces and government policies, for example, are also needed.

Résumé
De nombreuses technologies et disciplines scientifiques connexes peuvent apporter une contribution à la production plus propre. Les technologies basées sur les sciences de la vie et les biotechnologies devraient jouer un rôle croissant dans l'évolution des systèmes mondiaux de production vers des pratiques compatibles avec un développement durable. Mais les progrès scientifiques et technologiques ne suffisent pas pour inciter l'industrie à adopter le principe de production plus propre : il faut que s'y ajoutent les forces du marché et l'action des gouvernements.

Resumen
Una amplia gama de tecnologías y disciplinas de investigación pueden contribuir a una Producción más Limpia. Las tecnologías basadas en las ciencias de la vida y la biotecnología desempeñarán un rol cada vez más importante en impulsar los sistemas de producción globales hacia la sustentabilidad. Los avances científicos y tecnológicos no constituyen motor suficiente para impulsar a la industria a incorporar criterios de Producción más Limpia. Se requieren también, por ejemplo, presión del mercado y políticas gubernamentales.

A key prerequisite for CP is stakeholder recognition that the status quo is not satisfactory, that change is necessary, and that innovation rather than retrenchment is required. However, innovation should not be taken to mean only technological innovation.

This article discusses the role technology innovation can play in achieving CP and, beyond that, sustainable development, while recognizing that technology innovation is only one of the driving forces for CP.

The International Cleaner Production Information Clearinghouse (ICPIC) provides a series of very useful case studies showing how companies and other organizations have developed and implemented Cleaner Production, and what the environmental and economic benefits have been. A few practical conclusions can be drawn from these and similar case studies:

- Simple, intelligent techniques such as improved "housekeeping" can be very effective for achieving CP, as well as significant cost savings, and these techniques should be explored first. *Technology is not always the answer.*
- Appropriate adaptations of existing technologies often provide significant benefits in a short time at relatively low cost. *Unnecessary technological sophistication or complexity (technology "overkill") can be counterproductive and wasteful.*
- In many cases, available techniques and technologies are inadequate and solutions must be found through scientific research and experimental development. For effectiveness, this must be closely linked with technology assessment and appropriate feedback throughout the research/design/development process. *Technology innovation supported by simultaneous assessment and effective policies can be a very powerful tool to achieve CP.*

Driving forces for CP: technology is not sufficient

The OECD[1,2] has identified three interrelated macroeconomic driving forces for cleaner products and processes:

- market demand;
- advances in science and technology, and
- government policy.

The analysis carried out by the OECD leads to the conclusion that these driving forces must work in concert to advance the adoption of CP by industry.

Market forces can provide very powerful incentives for achieving CP because they affect the profitability of companies and therefore strongly influence company behaviour. They allow great flexibility in designing responses to publicly determined environmental objectives, so that industry can meet requirements by changing manufacturing processes or feedstocks, modifying the product or adopting/developing entirely new technology.

Advances in science and technology open up new opportunities and options for achieving CP. The private sector often has difficulty making the investments necessary for developing and incorporating CP technologies into existing systems, unless the benefits to be obtained are proven. This is because it is usually easier to measure the costs of technology innovation than the benefits, which may be complex and long-term. Achieving greater penetration of CP into industrial production will require joint R&D and demonstration efforts by government and industry.

Government policies to enhance CP can be the single most decisive factor in the development and industrial use of cleaner technologies. Legislation, regulation, guidelines, standards, government procurement, government support for R&D, and human resource education/retraining can encourage or discourage, accelerate or delay use of CP by industry, depending on their orientation or manner of implementation.

Obstacles can arise from the absence of policy or its enforcement, insufficient international harmonization, policy uncertainties and contradictions, or policies that ignore the particular conditions of individual sectors. Government policies should promote the best technologies and encourage their wide dissemination for industrial use.

While there is some understanding of macroeconomic drivers for CP, more study is needed at the microeconomic level concerning the motivation of companies that embark on CP initiatives. It is clear from CP case studies that a culture of innovation is more important than in-house technological expertise in determining whether a firm undertakes to develop/implement CP and persists to achieve this goal.[3] At the level of the firm, the microeconomic driving forces for CP map approximately onto the macroeconomic driving forces. However, they are somewhat different and are expressed as the need for:

- improved/sustained profitability/competitiveness and consumer goodwill (market forces);
- greater control of production and product quality (science and technology); and
- reduced environmental liability and risk man-

agement costs (government policy).

These three microeconomic driving forces must also work in concert to advance CP within the firm. Environmental benefits alone are generally not sufficient to motivate the selection of CP by a firm, since their customers are usually reluctant to pay more for products manufactured using CP.

Technology and CP

Approaches to CP can be grouped into three categories:

Level 1: Waste reduction at source
- good housekeeping;
- process modification;
- product modification;
- change of materials.

Level 2: Waste recycling
- internal recycling;
- external recycling (among different organizations – industrial ecology).

Level 3: Use of renewable resources
- biomass as a renewable feedstock for energy, fuels and chemicals;[4]
- other sources of renewable energy: solar, wind, tidal, small-scale hydroelectric.

These approaches involve a combination of technology (processes and tools) and techniques (ways that technology is used). Technology and techniques are mutually supporting in delivering CP, as seen in case studies. Performance assessment is the guide to determining the optimum combination of the two.

Chemicals and energy are critical sectors for CP technology in view of their importance to so many other industry sectors. Biotechnology also holds great promise for achieving sustainable industrial development. Most, if not all, technologies can be relevant to CP. A treatise could be written on the application of each field of technology to CP.

The following list provides a sampling of this wide scope.

Energy

Energy is a fundamental requirement for human activities, from cooking to industrial manufacturing to transportation and travel. The predominant energy source at present is fossil carbon, specifically oil, natural gas and coal. The industry has invested for decades, and continues to invest, in technology to divert/convert more waste into product, as well as to replace polluting chemicals and develop new more environment-friendly products.[5]

The efficiency of electrical technologies, specifically of electric motors, has increased significantly over the last few decades. More recently, fuel cell technology has developed to the point that it is now possible to use this technology to provide stationary sources of electricity and to power motor vehicles.[6] This latter application will greatly increase the energy efficiency of such vehicles, while eliminating the air pollution associated with internal combustion engines. As the energy densities of fuel cells increase, the cost will become more competitive with conventional sources of power. Hydro and wind power technologies continue to improve in efficiency and cost-effectiveness. Solar cells are not cost competitive with most other sources of energy, but find application in providing energy where there is no link to the power grid and there is enough sunlight to drive low-power systems or recharge batteries.

There is continued R&D on reducing the cost of producing renewable fuels such as ethanol and methane generated by pyrolysis or by bioprocesssing from biomass, as well as biodiesel derived from waste oils and lipids. In future, ethanol or some other product derived from biomass may be used to power some types of fuel cells. Research is also focusing on biological production of hydrogen, which would be the ultimate clean fuel.

Chemical technology

The chemical industry is key to advancing CP, as chemical products and processes are used as inputs in so many other sectors. Chemical technology has increased in efficiency, with decreased waste as a secondary benefit. This change has largely been driven by competition and regulation. It is estimated that the chemical industry reduced the overall waste produced per tonne of product approximately five-fold between 1975 and 1995. However, this has been offset somewhat by the two- to three-fold increase in production and increasing use of commercially produced chemicals in developing countries that occurred in the same period.

The reduction in waste per tonne of product has been accomplished by approaches ranging from improved housekeeping to improved processes and process control, development of new less polluting products, and more efficient utilization of by-products. Technology innovation has occurred in the areas of catalysts, sensors and reactor design, as well as materials and separations technologies. Recently the concept of Green Chemistry or "environmentally benign chemistry" (see box) has shifted the focus to reducing the hazard of chemical products and processes, and to controlling emissions and exposure.

It is relatively recently that a fresh look has been taken at incorporating environmental considerations, in a comprehensive manner, into the selection of chemical inputs and the design of chemical processes. A major effort is under way, led by organizations such as the US Environmental Protection Agency and the OECD, to advance education, training and technology in the field of Green Chemistry. Industrial biotechnology can be viewed as a subset of Green Chemistry involving bioprocesses that are more eco-efficient, and biologically derived chemicals that are more biodegradable than their conventional chemical counterparts.

Biotechnology

Biotechnology embodies a group of technologies that harness the chemistry of life forms to develop products and processes. Biocatalysis involves the use of enzymes or microorganisms to synthesize or modify molecular structures with great efficiency and specificity. Many reactions utilize naturally occurring enzymes or microorganisms. Others make use of enzymes or microorganisms that have been modified using mutation and selection techniques, including high throughput screening.

More recently, genetic engineering has been used to produce microorganisms that contain all the steps for a particular series of reactions in one cell ("metabolic engineering"), in effect turning the cell into a miniature chemical factory.

Biotechnology has begun to play an important role in the synthesis of fine chemicals to the extent that biocatalysis is becoming part of the general tool kit used by synthetic organic chemists, often providing environmental benefits. For example, BIOCHEMIE, a subsidiary of Novartis, has reported that for the production of one tonne of cephalosporin the conventional chemical process resulted in 31 tonnes of wastes requiring incineration, while its new enzyme biocatalysis process resulted in only 0.3 tonnes of such wastes. On the horizon are bioprocesses to produce a number of bulk and commodity chemicals as well as plastics utilizing biomass as a renewable feedstock. Bioprocesses naturally lend themselves to processing of biomass, a major renewable resource, into fuels (e.g. methane, ethanol) and chemicals (e.g. acetone, butanediol).

Sensors

A wide range of chemical, electrochemical and biosensors provide the means to measure the concentrations of chemical reactants and products, control processes and detect products or pollutants in real time (as compared to having to send samples to a laboratory for analysis).

Informatics

Information technologies can be used to design equipment and processes, as well as to control processes in real time at the site or from a remote location. Process design and simulation technologies can help with analysis and optimization of complex industrial systems and their impacts on the environment.

Separations

Separation technologies have evolved from simple distillation and extraction to gas and liquid chromatography, as well as affinity chromatography based on molecular recognition phenomena. Ultrafiltration using semipermeable membranes is widely used to separate mixtures of natural products. Supercritical extraction using CO_2 under high pressure can be used to extract flavours, perfumes and other fine chemicals with high selectively and no solvent residue.

Materials

Materials technologies include abrasion and corrosion resistant coatings; powder coatings which do not require solvents; and light-weight composite materials that save energy when incorporated into cars, trucks and airplanes.

Nanotechnology

Nanotechnology is the ultimate in materials technology.[8] It is the fabrication of devices or products with atomic or molecular scale precision. Some of the first examples of this technology are mirrors that don't fog, biomimetic paint with a contact angle near 180 degrees, gene chips and fat-soluble vitamins in aqueous beverages. While the field is still in its infancy, there is great interest in its potential to create entirely new products as well as to contribute to CP.

Materials shaping and cutting

Precision moulding (thermoplastic or metal/ceramic sintering), high-power lasers, high-pressure water jets, electrochemical etching and other technologies can replace conventional machining processes and save energy, as well as reducing waste by-products including such machining aids as cutting oils.

The importance of technology assessment

It is essential to measure the environmental performance of products, processes, and the technologies embedded in them if CP is to be achieved. Measuring a technology's performance includes consideration not only of the technology but also of how and how well it is used. Tools such as life-cycle analysis (LCA) have been developed to measure the environmental impacts of products and processes and the technologies embedded in them systematically.

LCA is an excellent tool at the microeconomic level for designers in individual companies to use in examining the environmental consequences of their decisions broadly and beyond the "plant boundary". LCA measures a range of environmental impacts. For example, one type of software (Simapro 4, developed by PRé Consults B.V. in the Netherlands) used in LCA includes the following parameters:

- eutrophication;
- CO_2 emissions;
- energy consumption;
- winter and summer smog;
- solid waste production;
- acidification
- carcinogenic substances;
- heavy metals;
- ozone-depleting substances.

Case studies using multi-parameter measures indicate that in many cases improvements in technology that move towards "cleaner" in terms of one parameter may simultaneously move away in terms of another parameter. Thus, potential trade-offs may have to be made or additional redesign undertaken to implement the technology.

Techniques such as LCA cannot readily examine society-wide macroeconomic issues such as sustainable development. This is because LCA answers the question "Is it cleaner?" while for sustainability the question is "Is it clean enough?".

However, it is possible to arrive at an estimate of what is clean enough based on present conditions and some simple assumptions. The question then becomes: If one is to approach environmental sustainability while achieving sustained economic growth, what should be the environmental performance targets for technology undergoing R&D today, relative to the performance of current industry-standard technology?

To answer this question, it is necessary to determine the environmental performance that will be required to keep the environmental "footprint" of the economy at a constant level. An equation that describes this is:

$$GDP(t) / F_e(t) = \text{constant}$$

where GDP(t) is GDP (global or national), as a function of time, and $F_e(t)$ is the economy's eco-efficiency (i.e. its average environmental performance), also as a function of time.

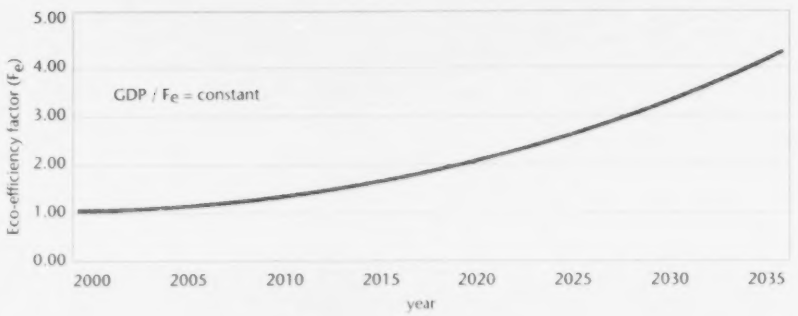
The following assumptions are built into the case shown in **Figure 1**:

- Environmental impacts are proportional to economic activity.
- For the sake of argument, economic growth is set at 4%.
- Increased eco-efficiency decreases the environmental impact of a given level of economic activity.
- If newly developed technology is now beginning to be introduced, it will take an average of 25 years for this technology to become the average practice for the industry as a whole.
- Technologies at the R&D stage today will take an average of ten years to achieve market readiness.

The line in Figure 1 represents the rising environmental impact from 4% economic growth without any changes in the environmental performance of the technology used. It shows that in order to bring the environmental impact back to its original level:

- Technologies ready for market today (and which take an average of 25 years to become average industry practice) should have environmental performance at least three times better than the current industry average (i.e. emissions only 33% of the current average).
- Technologies at the R&D stage today (and which will take an average of 35 years to become average industry practice) should have an environmental performance at least four times better than the current industry average (i.e. emissions only 25% of the current average).

Figure 1
Eco-efficiency required to keep the environmental footprint constant



If the present environmental impact is not sustainable, then the environmental performance targets for new technology to help address this will have to be raised even higher. It should be noted that a factor of 4 improvement is not a particularly aggressive target. For example, the Netherlands has established a sustainable development technology research initiative with a factor of 20 improvement as the goal, and the BIOCHEMIE example cited earlier achieved a factor of 100 improvement for reduction of hazardous waste.

Developing an integrating principle

At present, the application of a wide range of technologies for CP is scattered across industry without an integrating principle. Such a principle is needed to avoid wasting resources on incremental improvements in the cleanliness of industrial production systems that will never make it to "clean enough", i.e. sustainable. The need to shift towards an economy based on renewable carbon, because of the eventual depletion of fossil carbon resources, provides such an integrating principle: a means of setting global and national priorities for research and technology development, as well as for allocating our scientific and financial resources accordingly.

Developing an economy based on renewable carbon (a "Biobased Economy") means the strategic technology challenge for the 21st century is *to use Cleaner Production as the means of establishing a sustainable linkage between the carbon cycle in industry and the carbon cycle in the environment.*

The life sciences, particularly biotechnology, will play a prominent role in making this a reality. In fact, the Life Science Revolution will lead to a convergence of industry sectors including agriculture, chemicals, pharmaceuticals, forest products and informatics, as well as a period of economic growth surpassing that brought on by the Informatics and Telecommunications Revolution.[9]

Making the Life Science Revolution sustainable provides a robust integrating principle for Cleaner Production technologies. The US Department of Energy[10] presents a view of how this integration can be conceived, planned and executed through targeting the development of technologies in the near, medium and long term for:

- developing value-added plant varieties for food feed and industrial applications;

- high-yield, sustainable crop production;
- eco-efficient processing;
- sustainable utilization of the resulting products; and
- closing the loop back to the environment.

Opportunities and constraints

The vision of CP in the service of a "Biobased Economy" offers hope to both developed and developing countries. For developed countries, it presents the opportunity to use their technological abilities to head off major economic and social disruptions caused by fluctuations in the price of energy and petrochemicals as the supply of these finite, non-renewable resources continues to diminish.

For a number of developing countries, it provides the opportunity to potentially leapfrog the age of fossil fuels and petrochemicals to the age of biofuels and biochemicals, which are less toxic and more easily biodegradable and can be derived from locally grown feedstock, leading to local self-sufficiency. For example, d-limonene, derived from citrus fruit, is an excellent substitute for petroleum-derived solvents such as 1,1,1-trichloroethane in cleaning and degreasing applications.[1]

There are major challenges to overcome if these opportunities are to become realities:

Price

The historically low price of petroleum-derived chemicals, and the development of product standards based on these types of products, makes it difficult for alternatives based on renewable feedstock to compete on an equal footing in the marketplace. The recent increase in the price of oil may help offset this disadvantage, as can policy measures that reduce the cost of innovation and help develop the large-scale infrastructure required for processing renewable bio-resources.

Lack of interdisciplinary expertise

Integrating CP into the Biobased Economy will require cross-sectoral and cross-disciplinary research, as well as technology development/transfer and implementation on a very broad scale. The linkage of microbiology with chemistry and engineering and other relevant disciplines has yet to be made across a range of industry sectors. Networks such as the Cleaner Production centres can play a major role in this area.

Long lead times for CP technology development

Long lead times require careful selection and planning of investments in technology to ensure that, as far as possible, these investments pay off. In some cases, CP technology can be developed in phases so as to lower the overall risk of the project. Initiatives such as Technology Roadmaps can also lower the risk by helping identify market-driven priority areas for development of technologies, along with the relevant research disciplines and industry/university/government networks to undertake research, development, scale-up and technology demonstration.

The 12 Principles of Green Chemistry

1. Prevention
It is better to prevent waste than to treat or clean it up after it has been created.

2. Atom economy
Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.

3. Less hazardous chemical synthesis
Wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.

4. Designing safer chemicals
Chemical products should be designed to effect their desired function while minimizing their toxicity.

5. Safer solvents and auxiliaries
The use of auxiliary substances (e.g. solvents, separation agents) should be made unnecessary wherever possible and innocuous when used.

6. Design for energy efficiency
Energy requirements of chemical processes should be recognized for their environmental and economic impacts and should be minimized. If possible, synthetic methods should be used at ambient temperature and pressure.

7. Use of renewable feedstocks
A raw material or feedstock should be renewable, rather than depleting, whenever technically and economically practicable.

8. Reduce derivatives
Unnecessary derivativization (use of blocking groups, protection/deprotection, temporary modification of physical/chemical prosesses) should be minimized or avoided if possible. Such steps require additional reagents and can generate waste.

9. Catalysis
Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.

10. Design for degradation
Chemical products should be designed so that, at the end of their function, they break down into innocuous degradation products and do not persist in the environment.

11. Real-time analysis for pollution prevention
Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.

12. Inherently safer chemistry for accident prevention
Substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions and fires.

Source: Paul T. Anastas and John C. Warner, *Green Chemistry Theory and Practice*, Oxford University Press, New York, 1998. For more information, visit the American Chemical Society's site at *www.acs.org/education/greenchem*.

Lack of financing

CP often results in sufficient cost savings. The payback period for investment in CP technology innovation may be a few years or less. A key element for bringing in financing, whether from the company's own resources, the government or a financial institution, is building awareness of CP's economic benefits and the costs of continued pollution of the environment in the organization providing the financing. In this regard, tools such as LCA and Environmental Accounting can be useful. The use of Environmental Management Systems can also provide comfort to investors that the objectives of CP technology development will be met.

Lack of private sector entrepreneurs

Many CP technologies are commercialized by firms specializing in technology development. These firms service the technology needs of other firms that are users and adapters of technology but not developers. Some researchers in university and government and industry laboratories may have promising ideas for CP technologies that are not of interest to their current employer but could provide the basis for starting a new company. Some universities, government research agencies and companies have begun to provide flexible leaves of absence and even incubator facilities for researchers who want to spin out a company. Another factor in stimulating the flow of entrepreneurs is the example of entrepreneurs who have been successful and have benefited financially from their efforts.

Lack of government support for this kind of research

Government is one of the prime funding sources for fundamental and applied research with potential societal benefits, such as that on CP. Government priorities for supporting R&D are often focused on technologies and products with commercial potential. In some cases, CP is not seen as having commercial potential or direct economic benefits. Initiatives such as those of UNEP, OECD and other international organizations can be very important in showing government policy-makers and programme managers that CP can also have major economic benefits and create/preserve jobs.

Distrust of technology and corporations

A number of consumer and environmental groups have developed a deep distrust of technology, and of many of the corporations that develop and commercialize technology. CP is seen as an imperative by many of these organizations. This may provide an opportunity to develop a constructive dialog on the issues surrounding technology and CP. Consumer understanding and confidence in the performance of CP technologies is one means of stimulating the market forces driver for CP.

Conclusion

Technology innovation can be a very powerful tool for achieving CP if it is informed by effective technology assessment and supported by effective policies at the company level. A wide range of technologies and related research disciplines can contribute to CP. However, advances in science and technology are not sufficient as a driver for achieving CP. Market forces and government policies must also work in concert with technology to advance industry's adoption of CP. Thus, a wide range of different communities representing quite different perspectives must come together to help achieve CP.

One integrating principle for CP, which focuses on sustainability, is use of CP technologies to establish a sustainable linkage between the carbon cycle in industry and the carbon cycle in the environment. Technologies based on life sciences and biotechnology, in particular, will play an increasingly prominent role in moving global production systems toward this ultimate goal of sustainability.

For the full text of the background paper from which this article has been taken, as well as complete references, see the CP6 web site (*www.uneptie.org/cp6*).

Notes

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Industrial ecology: a new Cleaner Production strategy

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Summary

Concepts, strategies and tools for applying the principles of industrial ecology to Cleaner Production planning at "system level" are presented. For the industrial system to evolve towards sustainability, waste and by-products should be valorized systematically, losses due to dispersion minimized, economies dematerialized, and energy produced from sources other than hydrocarbons. With the aim of testing and adapting the "industrial metabolism" methodology, the authors carried out a number of studies in India.

Résumé

L'article présente des concepts, des stratégies et des outils pour appliquer les principes de l'écologie industrielle à la planification de la production plus propre au niveau du "système". Pour que le système industriel évolue vers des pratiques compatibles avec un développement durable, il faut systématiquement valoriser les déchets et les produits dérivés, réduire le plus possible les pertes par dispersion, dématérialiser les économies et produire de l'énergie à partir de sources autres que les hydrocarbures. Les auteurs ont mené plusieurs études en Inde afin de tester et d'ajuster la méthodologie du "métabolisme industriel".

Resumen

Se presentan conceptos, estrategias y herramientas para la aplicación de los principios de ecología industrial en la programación de producción más limpia a "nivel de sistema". Para lograr que el sistema industrial evolucione hacia la sustentabilidad, es necesario valorizar sistemáticamente los desechos y subproductos, minimizar las pérdidas por dispersión, desmaterializar las economías, y generar energía a partir de otras fuentes que no sean hidrocarburos. Los autores desarrollaron una serie de estudios en la India con el objeto de evaluar y adaptar la metodología de "metabolismo Industrial".

When societies became conscious of the effects of the environmental degradation caused by human activity, the first strategy conceived was that of building filters to ensure that waste from industries did not "leak" into the environment. However, analysis showed that better strategies were required. The process of building filters only transferred pollutants from one medium to another (e.g. from water to land). The process of building filters was also not very economical. No savings accrued from this process.

Cleaner Production strategies then evolved which looked at possible changes in processes or parts of processes to minimize waste. With this change, the economics of production often improved, as less waste meant better material utilization. Hence Cleaner Production and eco-efficiency became part of corporate strategies.

Cleaner Production and eco-efficiency are still mainly targeted towards particular manufacturing processes and business strategies within individual companies. One could think of going even further, and trying to apply Cleaner Production

at the level of a cluster of various companies or that of an industrial zone or even a whole region – in other words, applying Cleaner Production at the level of a system. For the past few years, this emerging approach has been known as "industrial ecology".

The industrial ecology philosophy and agenda

The industrial system can be seen as a certain kind of ecosystem. Like natural ecosystems, it can be described as a distribution of materials, energy and information flows. Furthermore, the entire industrial system relies on resources and services provided by the biosphere, from which it cannot be dissociated.[1,2]

To avoid confusion, we would like to specify what is meant in this article by "industrial metabolism" and "industrial ecology".

Industrial metabolism is the whole of the materials and energy flows going through the industrial system. It is studied using an essentially analytical and descriptive approach (basically an application of materials-balance principles). This approach is aimed at understanding the circulation of materials and energy flows – linked to human activity – from their initial extraction to their inevitable reintegration, sooner or later, into the overall biogeochemical cycles.[3–7]

Industrial ecology goes further. The idea is first to understand how the industrial system works, how it is regulated and its interaction with the biosphere, and then, based on what we know about ecosystems, to determine how this system could be restructured to make it compatible with the way natural ecosystems function.

From a practical point of view, one of the first analogies that comes to mind is that of an "industrial food chain". Just as in natural ecosystems, where certain species feed on the waste or organisms of others, one can imagine a process of waste recovery among various economic entities. Thus the concept of "eco-industrial parks" (EIPs) originated in the early 1990s. EIPs are areas where companies cooperate to make the most of resource use, namely through mutual recovery of the waste they generate (waste produced by one enterprise being used as raw material by another).

The main challenge is therefore reorganizing the industrial system in depth: this is commonly referred to as "eco-restructuring". Eco-restructuring will help the industrial system evolve towards a sustainable long-term operating mode compatible with the biosphere. In concrete terms, four challenges must be met within the framework of industrial ecology:

Waste and by-products need to be valorized systematically

Just as in the food chain processes of natural ecosystems, we must create networks of resource and waste use in industrial ecosystems so that almost all the residues become resources for other enterprises or economic entities (through eco-industrial networks). Traditional recycling is only one aspect of a series of matter flow recovery strategies.

Loss caused by dispersion needs to be minimized

Increasingly, human consumption and use tend to cause more pollution than actual manufacturing. Products such as fertilizers, pesticides, tyres and solvents are entirely or partially dispersed into the environment as they are used. New products and services that minimize dispersion, or at least eliminate its harmful effects, must be designed.

The economy needs to be dematerialized

The objective here is to minimize matter (and energy) flows while making sure equivalent services are provided. Due to technical progress, it is possible to obtain more service from a smaller amount of matter by producing lighter objects or replacing matter (e.g. replacing copper cable use with fibre optics in telecommunications). However, dematerialization is not simple. Less massive products may also have shorter life spans, in which case they will ultimately consume more resources and generate more waste. Dematerialization applies not only to goods for consumption, but also in large part to the industrial system's heavy infrastructure (buildings, roads, etc.).

Energy production needs to rely less on fossil fuels

From the beginning of the Industrial Revolution, fossil fuels (coal, oil, gas) have powered the engines of industrial economies. However, they are also at the root of many current problems including the greenhouse effect, smog, acid rain and oil spills. We must make hydrocarbon consumption less harmful (e.g. by recovering gases emitted by combustion) and encourage the move towards reduced consumption (e.g. through renewable energy use, energy savings). In abstract terms, the "energy" function must be separated from its "fossil carbon" substratum.

Industrial ecology in practice: studies in India

Looking beyond Kalundborg

The story of Kalundborg, Denmark, really begins in 1961, with a project to use surface water from Lake Tisso for a new oil refinery to preserve limited ground water supplies. The city took responsibility for building the pipeline, while the refinery financed it. A number of other collaborative projects were introduced and the number of partners gradually increased. By the end of the 1980s, the partners realized they had effectively "self-organized" into what is probably the best-known example of a working industrial ecosystem or, to use their term, *industrial symbiosis*. The industrial symbiosis in Kalundborg is an example of how strategic material-based planning can earn a handsome payback.

There is no doubt that the Kalundborg model has fruitfully inspired recent thinking on environmental management of industrial estates and eco-industrial networks. However, there is also growing recognition that we need to look beyond Kalundborg. This is especially true with respect to implementation of industrial ecology in developing countries, where the industrial pattern is very unlike that of Kalundborg.[8]

Industrial metabolism in the context of a developing country

In an attempt to test and adapt the methodology of industrial metabolism in the context of a developing country, the authors have undertaken various studies in India. These studies' purpose has been to try and develop a broad conceptual framework for planning strategies that use basic principles and concepts drawn from industrial ecology.

We present in this article the methodological framework developed for the studies.[9] From this new perspective, approaches to planning in a defined socio-economic system (e.g. city, state, country or any other clearly defined region) could involve:

- analyzing the "flow of resources" through the system;
- redefining issues in the context of "resources";
- setting priorities for action and identifying resources whose use is of immediate concern;
- carrying out a detailed analysis of the utilization of identified critical resources;
- preparing a strategic plan for optimizing use of selected resources;

Graphically, the flow of resources can be represented as in the diagram in Figure 1.

Material or resource flow analysis

In the context of system-level planning, especially when the object is to optimize use of scarce resources, *Material Flow Analysis (MFA)* could be referred to as *Resource Flow Analysis (RFA)*.[10]

Analysis of the flow of materials and energy used in an economic system, including the quantity of resources used, the way they are used and the impact of their use on the local environment, could form the cornerstone of planning. Analysis of the flow of resources could generate criteria on the basis of which a development agency might plan activities in a region.

In Figure 2, we present a possible framework within which issues could be discussed. The "flow" of resources through the socio-economic system is represented. Land is specifically included as an important resource, whose "flow" or use by different economic sectors needs careful and critical examination in view of many developing countries' high population density and the consequent high demand from different economic sectors.

One aim of a resource-based development plan could simply be to ensure that total flow of resources, particularly scarce resources or resources whose use or disposal can be harmful, is optimized. This can be achieved by:

- eliminating the use of such resources;
- reducing the use of such resources, e.g. through substitution of lighter or benign materials that perform the same function;
- recycling wastes so that the same quantity of resources performs its function many times before being discarded to the environment, thereby

increasing resource productivity:

- substitution with a more efficient resource, whose use and the ensuing flow of wastes to the environment will consequently be minimal;
- substitution with a resource whose availability is "inexhaustible" (at least from the human perspective), e.g. solar or wind energy.

Regional Resource Flow Analysis (RRFA)

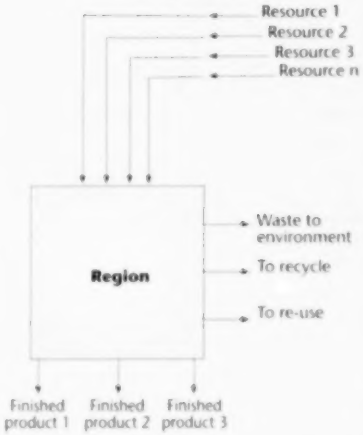
As mentioned earlier, preparation of a Regional Resource Flow Diagram like that in Figure 1 could be useful for understanding the flow of resources in a selected geographic region. This would clearly show the quantitative inputs of resources to the selected region and outputs from the region, both as wastes going to other regions for reprocessing and as wastes going to the environment, apart from end-products for sale or consumption.

A diagram such as this would immediately give a detailed quantitative account of the flows of different resources within an area. If establishing priorities for action is a development fund requirement, the first step might be to prepare a Regional Resource Flow Diagram clearly indicating resources of significance. Since the consumption figures for all resources are clearly quantified, it would be easy to assess any resource's relative importance within the region.

For each resource which is an input, the questions needing to be asked are:

- Is the resource scarce within the region?
- Is the availability of the resource likely to be a problem in the future?
- Is use of the resource likely to cause damage to any other resource?
- Can the resource be more profitably utilized in the sphere/segment or be put to more profitable use?

Figure 1
Regional Resource Flow Diagram (RRFD)



Redefining problems

Once a quantitative analysis of the "flows" of different resources within the region is available, it may be necessary to redefine problems from the perspective of resource utilization. For example, it is often said that of liquid effluent from a particular industry that it does not meet the norms laid down. The same issue could be presented as the industry using water (often a scarce resource), and the effluent from the industry spoiling another resource such as soil or ground water. The reason for such a redefinition is that if the effluent does not affect any other resource within the region, it is not of much consequence and therefore not a major problem. However, if the resource the industry is using is scarce, and if the industry causes damage to other scarce resources within the region, immediate attention is required. Hence problems need to be considered specific to a location.

Setting priorities

Based on a Regional Resource Flow Diagram, it is possible to identify and prioritize resources that need more detailed attention.

If analysis of the regional resource flow is to be translated into an action plan, priorities for action have to be established. If action is to be initiated, these aspects need to be studied:

- Is action needed?
- Which particular sector needs it?
- Is action possible?
- What would the consequences of any action be?

While setting priorities, it is necessary to prioritize areas where action will yield results. Thus the results indicated by a Regional Resource Flow Diagram may need to be examined in conjunction with many other factors.

Analyzing use of resources

Having set priorities and selected the resources for closer scrutiny, it is necessary to analyze in greater detail how the particular resource selected as a priority is used in the identified region. The questions that need to be answered are:

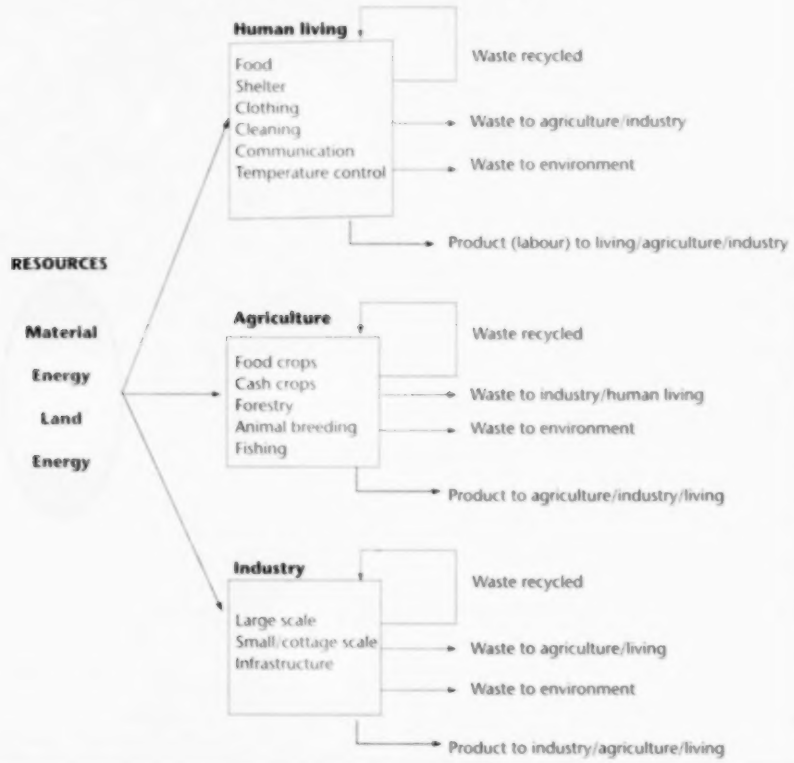
- Who uses the resource?
- Can usage be optimized?
- Can users find an alternative resource?
- Can the resource be harnessed in a better way (e.g. through water harvesting techniques)?
- Can users be removed from the system or region?

Preparation of a Resource Utilization Map (RUM) along the lines shown in **Figure 3** could provide a coherent framework to help answer these questions. It is important to understand as well as possible the behaviour of each category of users of a given resource: what they use it for, and how much of it they use. This information could be used effectively to plan a strategy for optimization of the resource's use.

Any Strategic Resource Management Plan needs to take into account the following elements:

- very clear definition of objectives;
- possible options to achieve the goal;
- optional action plans;
- the cost assessment of each action plan and time frame;
- likely consequences/results of each option;
- evaluation of options;
- selection of a specific action plan;
- setting of time-bound goals;
- evolution of a system to evaluate progress.

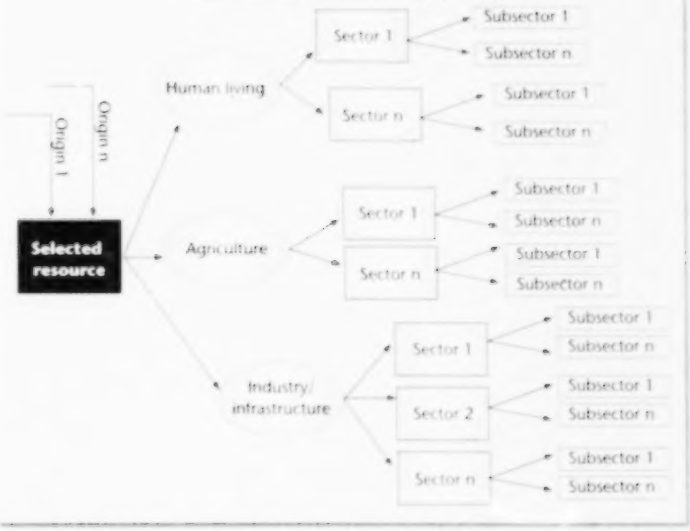
Figure 2
Flow of resources in an economic system



Possible strategy options

Clear definition of objectives can be aided by figures generated through the RREA and RUM. What could be interesting, in the context of industrial ecology, would be discussing the kind of strategy options generated.

Figure 3
Resource Utilization Map (RUM)



Using resources that are wasted (closing the material cycle)

Study of a Regional Resource Flow Diagram provides an initial idea of the quantity of different resources that are input to the environment from a given geographic region. These data could be used to develop new economic activities or an industrial undertaking that would make use of wastes.

Planning integrated closed material cycle economic activity

If, for example, a new industrial area or industrial estate is envisaged, it may be possible to plan the types of industries to be set up in such a way that wastes from one unit in the area are feedstock for another. Hence individual industries in the cluster become partners in a quasi-closed cycle. This replication of the Kalundborg model is attempted in the planned eco-industrial parks (EIPs) or networks (EINs).

This planning could also take the form of linking and interconnecting different economic subsystems within a region.

Reducing or eliminating use of selected critical resources

Reduced resource consumption could be achieved through either a change in technology or improving the efficiency of the same technology. Similarly, waste minimization programmes could be specifically planned to achieve clear targets for identified scarce resources within the region.

Recycycling materials within the same user sector

A targeted industry could be encouraged to recycle its own wastes, which would help it reduce resource use.

Strategically relocating industries that use critical resources

Mainly for historical reasons, many industries grow in areas where their resource requirements are quite incompatible with resource availability. Such industries might could be relocated.

Conclusions

The concepts presented here offer a number of perspectives for policy-makers:

- The methodology is intended to allow countries to map flows of materials through their entire economic system. This will show what the critical resources are.
- From such a model, the loose ends are very obvious and immediately give an indication of unused or under-utilized resources.
- In specific instances, this information can be used to plan integrated industrial complexes.
- This methodology is relevant on various scales: local, regional, national.
- Such studies of different activity groups can be aggregated to provide an overall picture of material flows within a region. Based on this, planners can consider the promotion of industries in specific sectors, which would optimize the use of critical resources.
- Information and understanding generated by material flow analysis can be used as a tool in planning socio-economic development. Such a tool can be useful for local and regional government, or for international development agencies and financial institutions.

Finally, from a business point of view, this approach serves two purposes. First, it can offer new options for industries under great pressure from governmental authorities with responsibilities for controlling environmental pollution. Second, it can expose companies to the larger picture and make them aware of the total range of materials used in a cluster, zone or region. As large numbers of small manufacturers use the materials, an aggregation (as has been shown) can be revealing and may become a catalyst for action. Even more important, such data can reveal new business opportunities. Moreover, knowledge of opportunities to use resources better could be of interest to companies in the context of globalization and of increasing competition from neighbouring countries.

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10. The word "resource" as used in this article specifically refers to material and energy resources. In some cases this can include land and manpower.

Cleaner Production information: the importance of interNET-WORKING

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Summary

One outcome of CP6 was the commitment to develop a Global Cleaner Production Information Network. The responsibilities, level of effort and resources required to maintain such a global network are outlined, based on experience with existing networks. Four existing regional efforts to improve information exchange are described.

Résumé

L'un des résultats de CP6 est la volonté de mettre en place un réseau mondial d'information sur la production plus propre. En se référant aux réseaux existants, l'article évoque les responsabilités, les efforts et les ressources nécessaires pour faire fonctionner un réseau mondial de ce type et décrit quatre initiatives régionales pour améliorer les échanges d'informations.

Resumen

Como uno de los resultados de CP6 surgió el compromiso de desarrollar una Red Global de Información de Producción mas Limpia. Se describen las responsabilidades, nivel de compromiso y recursos requeridos para mantener dicha red global, en base a la experiencia de redes existentes. Se describen cuatro emprendimientos regionales vigentes para incrementar el intercambio de información.

An important development in the Cleaner Production world involves moving away from the era of isolated case studies and demonstrations towards broad-based implementation of Cleaner Production principles. To succeed in this transition, we need better, more cost-effective ways to disseminate information, share experiences, and build networks of Cleaner Production practitioners (Kasman, 1999).

Despite the abundance of Cleaner Production information on the internet, this information is fragmented among agencies, centres and roundtables. Access varies from region to region. Businesses, practitioners and government programmes are often unaware of the services and information available to assist them. At the end of the 1990s, several networks emerged to help regional Cleaner Production communities find and share internet-based Cleaner Production information and resources.

Regional networks have an essential role in coordinating the information produced and disseminated worldwide. However, these networks themselves need to coordinate access to their collective information, research and expertise while avoiding duplication of efforts.

Four existing regional efforts to improve information exchange are described below.

■ UNEP's Work Group on Cleaner Production information sharing

http://c2p2.sarnia.com/cpinfoindex.html

One of the key outcomes of UNEP's 5th International High-level Seminar on Cleaner Production in Seoul was a recommendation to establish a new Work Group on Cleaner Production information sharing. Chaired by the Canadian Centre for Pollution Prevention (C2P2), this Work Group is devoted to:

- fostering regular communication between Cleaner Production information providers;
- improving the organizational capacity to disseminate information.

The Work Group established a list-server, an e-mail list service linking 70 information providers and practitioners from 26 countries to discussions dedicated to sharing of information.

While e-mail discussions can encourage meaningful exchanges, most fail in gathering useful input, let alone stimulating debate. To produce the most effective discussions:

- the C2P2 acted as a facilitator and stimulated discussion by proposing discussion items;
- discussions were structured to lead to a conclusion or plan of action;
- material not relevant to effective information sharing was tabled for future discussion;
- subscribers were asked to respond to questions within a defined time;
- dialogue was summarized and sent back to the list-server;
- a summary of key discussions was posted on the C2P2 site; and
- all subscribers and their e-mail addresses were posted on the C2P2 site.

Discussion and posted questions focused on three key areas:

- existing networks for increasing communication;
- barriers that information providers face;
- collaborative efforts for Work Group members.

Discussion confirmed that while there is no shortage of information systems supported by individual centres and roundtables, only a few regional networks exist. Sustaining information programmes (funding) was one of the highest priorities – and greatest challenges – identified by information providers. Mandar Parasnis of the Thailand Environment Institute's Cleaner Technology Information Center (CTIC) noted that since the CTIC's inception its self-sustainability has been a major issue of concern (Parasnis, 1999).

To help information providers overcome barriers and deliver their programmes more effectively, one recommendation has been to create an internet-based global network. The recommended internet site would link the growing number of regional Cleaner Production initiatives, National Cleaner Production Centres (NCPCs), roundtables and other Cleaner Production activities worldwide.

■ Pollution prevention resource exchange (P2Rx)

http://www.p2rx.org

In 1994, the US Environmental Protection Agency funded a three-year pilot project to establish a model programme to enhance information sharing between two established regional pollution prevention programmes. The scope of this work was unique, focusing exclusively on methods for facilitating coordination and information sharing between regional centres.

The regional centres, representing large pollution prevention communities, coordinated their activities through conference telephone calls, face-to-face meetings and e-mail. Collaborative efforts included sharing strategic plans, joint internet training, development of industry-specific information manuals, and updating regional databases. This interest, and the ability to leverage resources across regions, was not developed instantaneously: it took time to create a close relationship. Through formally bringing together the two regional centres, it was possible to leverage and benefit from others' skills and knowledge (Regenstein, et al. 1998).

This pioneering work, and the recommendations in two reports from the US National Pollution Prevention Roundtable, reinforced the need to establish a National Pollution Prevention Network (Kerr et al., 1995; Liebl et al., 1997).

Today the Pollution Prevention Resource Exchange (P2Rx) is a network of nine regional pollution prevention centres in the United States. These centres offer a variety of resources, includ-

ing information for specific industry sectors, training, libraries, referrals and research. Through P2Rx, the nine centres are laying the groundwork for a seamless national network of easily accessible, high-quality pollution prevention information.

■ Asia-Pacific Cleaner Production Roundtable (APCPR)

http://www.apcpr.org

The APCRP internet site, established in 1999, was designed to provide tools to Cleaner Production practitioners and support the Roundtable's working groups. Besides an on-line identity for the APCPR, the site conveys technical and policy options to practitioners in the field, including:

- industry-specific Cleaner Production guides;
- facilitated on-line dialogues;
- a gateway to Cleaner Production roundtable sites and information;
- regional meeting and training opportunities; and
- access to Cleaner Production networks in other regions of the world.

■ Roundtable of the Americas for Cleaner Production

http://esdev.sdc.moses.com/latin/

In October 1999, the Steering Committee of the Second Regional Conference of the Americas on Cleaner Production in Bogota, Colombia, agreed on the idea of creating a web site for the Roundtable. An Information Working Group including Argentina, Bolivia, Brazil, Chile, Mexico and the United States was designated to design a test site.

Challenges facing networks

The challenges facing existing networks have been established. For the collaborative effort proposed in this article to be successful, it is essential to plan how to overcome the predicted challenges and barriers.

Networking at any level is exceptionally difficult. The greatest challenge concerns resources – both time and money. A coordinated global effort only accentuates this need.

Long-term funding commitment

Practitioners in the United States operate established information networks at both national and regional levels. Based on their experience with sustaining information efforts, it is their recommendation that a national pollution prevention network and regional information centres cannot develop without adequate fiscal support. They also confirm what many information networks are beginning to experience with some frustration: a growing number of information tools are available, but resources devoted to coordinating and maintaining them are inadequate (Regenstein, 1998).

The regional partners interested in creating and maintaining a Global Cleaner Production Information Network must work with private and public sector organizations to solidify long-term funding commitments to maintain the Network and strengthen regional infrastructures.

Regional capacity

While the internet is widely available, and its value to some regional partners and their clients is increasing, many countries and regions are not fully integrated or linked to the internet. Traditional methods of information delivery, such as personal contact and hard copies, will remain essential (UNEP, 1997).

The Global Cleaner Production Information Network must communicate through a variety of exchange mechanisms. These include meetings and conference calls, as well as electronic communications.

Regional infrastructure

As emerging centres are established and grow, the Global Cleaner Production Information Network will be invaluable. It can provide assistance, reduce duplication of effort, and help new centres build on the capacities of established networks. But regional contributors will also need financial support to prepare and adapt their own information to the coordinated Network.

The Global Cleaner Production Information Network must leverage long-term funding to strengthen regional infrastructures.

The language barrier

Many Cleaner Production information systems only exist in English, whereas most of the world population does not use English as a working language. No matter how relevant information is, it will be of little value to the practitioner or decision-maker who does not know the language (UNEP, 1997).

With effective coordination and long-term collective planning, the Global Cleaner Production Information Network could use combined regional resources to support translation of information into languages other than English.

Level of effort and commitment

Perhaps the most misunderstood element of any networking initiative is the amount of time, and level of effort, needed to build the relationships necessary for successful communication. The Network Host and Regional Contributors often underestimate the time required to prepare material, populate websites, actively participate in discussions and encourage unresponsive contributors. The P2Rx Coordinator estimates that 85% of her time is allocated to coordination and to communicating with regional centres.

The Asia-Pacific Roundtable on Cleaner Production identified continuous commitment and dedication (by the leaders of the network, regional partners and the network host) as vital to the success of any network.

The network host should be an organization prepared to allocate adequate long-term staff time to develop and maintain the network and to coordinate Regional Contributors. Regional Contributors must assign a main point of contact whose primary responsibility is ensuring that regional content is supplied regularly to the network.

Launching a permanent global network

One outcome of CP6 was the commitment to develop a Global Cleaner Production Information Network. It is time to join in a permanent network that goes beyond annual meetings, truly links practitioners in isolated Cleaner Production centres, and encourages ideas and innovation.

Recommendations for establishing a Global Cleaner Production Information Network are outlined below.

Target audience

While the primary audience for most Cleaner Production assistance is industry, ultimately managing Cleaner Production information through a network designed for practitioners will better serve the business users of information. Cleaner production practitioners are generally professionals in universities, industry associations, Cleaner Production centres, roundtables, NGOs and government agencies – those who provide outreach and support to industry on Cleaner Production techniques and policies.

Goal

The Global Cleaner Production Information Network will:

- foster regular communication between Cleaner Production information providers; and
- improve the capacity of organizations to disseminate information.

In addition to facilitating greater access to Cleaner Production information, this collaborative effort will help avoid duplication of activities, promote strategic planning, and help set priorities in Cleaner Production activities.

Network structure

The Global Cleaner Production Information Network will be anchored by an internet website. The internet-based forum will share practical tools and relevant information sources, champion and track projects adopted by practitioners, and provide better access to training and conference opportunities. The site will collect and disseminate the type of data and information that will help promote Cleaner Production concepts and tools to target audiences of practitioners.

Hard copy material will be sent to support practitioners without access to electronic forms of communication.

Network guidance

A working group of Cleaner Production regional contacts has been established to provide initial direction to the Global Network and its host organization. They will be responsible for:

- active involvement in contributing and communicating on behalf of their own region;
- identifying regional information and capacity needs;
- identifying a regional contact to contribute to the network and participate in collaborative projects;
- promoting use of the Global Cleaner Production Information Network;
- ensuring that regional content is featured on the Global Cleaner Production Information Network; and

- contributing to joint funding proposals and to securing government, private and corporate funds.

Regional partners/networks that have confirmed their interest in supporting and contributing to the Global Cleaner Production Information Network include:

- the Asia-Pacific Roundtable on Cleaner Production;
- the Canadian Centre for Pollution Prevention;
- the European Network on Good Environmental Practices (GEPnet);
- the National Cleaner Production Centre, Brazil;
- the Roundtable of the Americas for Cleaner Production;
- the Slovak Cleaner Production Centre;
- the UNEP/UNIDO National Cleaner Production Centres (NCPCs);
- the United Nations Economic and Social Affairs Department;
- the United States National Pollution Prevention Roundtable;
- the United States Pollution Prevention Resource Exchange (P2Rx); and
- the International Cleaner Production Cooperative.

Regional contributors

The Global Cleaner Production Information Network will be a centrally integrated system with decentralized management. While there will be a coordinating Network Host, regional partners and existing networks would be responsible for preparing their own information or continuing to manage their own sites. The Global Cleaner Production Information Network will serve the needs of both experienced practitioners and emerging initiatives.

Regional centres, networks and roundtables would designate a contributor to the network. While the Network Host would be responsible for the upkeep of the Global Cleaner Production Information Network, the regional coordinators would continue to prepare their own information or manage their own sites.

Network content

The critical role of information in advancing pollution prevention and Cleaner Production has long been recognized. Organizations and individuals need to understand the available alternatives, and their ramifications, prior to making changes to daily practices, facilities and products.

Typically, Cleaner Production centres and networks provide information targeted to specific audiences (e.g. industry and governments). Emphasis is placed on provision of technical reports, case studies, industry referrals, on-site assistance and newsletters (OECD, 1999).

At the annual meeting of UNEP/UNIDO National Cleaner Production Centres in Berne in 2000, participants identified access to practical tools that could applied in their day-to-day work, and shared with clients, as their most pressing need. Many expressed an interest in identifying the key contacts and knowing what is happening or emerging in Cleaner Production.

The Network will provide practitioners and decision-makers with a roadmap for existing resources. Some tools which could be shared in the Network and among support practitioners in the field include:

- industry-specific Cleaner Production information;
- facilitated on-line dialogues on current Cleaner Production issues;
- databases on key topics (e.g. ISO 14000, benchmarking);
- directory of Cleaner Production/pollution prevention contacts and networks;
- meeting and training opportunities;
- on-line training materials;
- roundtable and Cleaner Production centre background/work group information; and
- Cleaner Production Declaration monitoring.

Network platforms

One of the Work Group's first issues for discussion and decision will be whether to use an existing electronic platform or design a new website.

An existing site: the International Cleaner Production Cooperative

http://es.epa.gov/cooperative/international/

The International Cleaner Production Cooperative is one example of an existing tool that allows users to retrieve technical and policy data from around the world. Through a sophisticated search engine that supports both simple and complex queries, the Cooperative gives access to information from all participating centres around the world. It is unnecessary to remember and access numerous and separate websites (Kasman, 1999). The Cooperative is designed and operated by the US Environmental Protection Agency.

Establishing a new internet presence

To make the internet site easy to manage, the entire site including graphics and site navigation should be dynamically generated. Look and content can be controlled by several databases. Computer programs read the information from the databases and create web pages "on the fly", as each visitor browses the pages. A consistent and uniform look is therefore maintained, and the information and navigation system is easy to update.

The site can incorporate a style sheet to control all graphics and text for consistency. Both would be managed via the Administration System. All database content can be managed through a password-protected Secure Online Administration System. Changes to databases are instantly available on the site. Regional contributors can have access for updating their own information online through the databases. When regional input is not forthcoming, the Network Host will at a minimum update regional information quarterly.

Network Host

The Cleaner Production community will own the Network. Funding partners and regional contributors will be recognized prominently on the site's home page.

One organization should coordinate the Network, dedicating at least one full-time staff member to serve as project manager. This clearly designates an organization with the responsibility for coordinating regional networks to share information and work together.

All models of network coordination will be evaluated and considered by the Work Group. The selection of either an existing or new platform for the Network will ultimately influence the choice of Network Host.

Using an existing site

Should the Global Cleaner Production Information Network operate from an existing internet presence, it will be the responsibility of the host of the existing site to outline specific requirements. Issues to be considered include ease of use of the existing site; ease of incorporating changes; how regional partners contribute to the site; access to uploading; available technical support; and resources available to support regional coordination.

Development of a new internet presence

If the Global Cleaner Production Information Network required that a new internet presence be developed, the Working Group would be responsible for selecting the Network Host. The Network Host would be responsible for all project management, overseeing the technical aspects of site design and designating the necessary long-term staff support to coordinate the Network.

Network coordination

Regular contact with regional contributors will be essential. Methods of coordinating activities should include face-to-face meetings (scheduled to coincide with regional meetings), conference calls and e-mail. Supporting hardcopy through mail or fax will be used as necessary.

Sustaining the network

Establishing and maintaining the Global Cleaner Production Information Network will require long-term commitment from funding agencies and from regional networks.

The Global CP Information Network and the regional infrastructure will not develop without stable, long-term funding sources. While there is an abundance of Cleaner Production information on the internet, inadequate resources are devoted to coordinating and maintaining them.

Regional networks also have an essential role in sustaining the network. Without the commitment to share information and actively participate in the Global Network, the CP community will never improve organizations' capacity to disseminate information. Equally important is securing long-term funding to strengthen regional infrastructure.

Recommendations for the next steps

- Develop Terms of Reference for the Working Group;
- Confirm Working Group membership;
- Identify the Network Host and outline the immediate responsibilities;

- Confirm the use of existing platforms or the need to design a new website;
- Secure stable, long-term funding sources to maintain the Global CP Information Network, and invest in and strengthen regional infrastructure;
- Coordinate existing information networks and confirm how they can adapt their site or existing information.

Note

1. For contact information concerning regional partners and existing networks, see Appendix A of the CP6 background paper on which this article is based (*www.uneptie.org/cp6*).

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"Untold stories"

India

Sustained Cleaner Production implementation requires prior analysis and taking into account of ongoing changes in market and political contexts.

An Indian textile dye manufacturer produces vinyl sulphone, a dye intermediate, resulting in a large amount of waste mother liquor with very high COD. A Cleaner Production programme in the company identified the opportunity to recover by-products (70% sulphuric acid and Glauber's salt). Implementation of this measure, while capital intensive (US$ 360,000), was attractive both economically (payback period of 1.5 years) and environmentally (50% COD reduction and elimination of gypsum sludge from the waste water treatment plant). It was therefore agreed to by management.

Despite 18 months of successful operation, the recovery plant was discontinued. Among the reasons:

- start of production of a huge quantity of 92% sulphuric acid (as a by-product) by a nearby copper smelting unit, capturing the entire market for weak acid;
- a change in government tax policy, and imposition of excise duty on recovered acid;
- a complete ban on sale of weak acids due to instances of their illegal dumping.

The lessons to be learned are:

- During economic analysis, possible changes in market price due to opening up of other sources of supply, competition, etc. should be looked into.
- The impact of forthcoming government policies should be anticipated and accounted for.

For more information about Cleaner Production in India, contact the UNIDO/UNEP NCPC, Dr. PK Gupta, at: ncpc@del2.net.in.

China

Market competitiveness could be a major incentive for companies to adopt Cleaner Production

An international donor-funded Cleaner Production audit was carried out at a medium-sized enterprise – a typical government-owned installation, Cement Mill A, in a medium-sized city in northern China. It was hoped that more international investment would therefore be attracted.

For the demonstration project, the municipal government organized an initial meeting of enterprise managers, who signed contracts to carry out Cleaner Production audits. Once it was known that additional funding was not likely, support for the demonstration project dropped radically. The audit was eventually completed after continual urging from external experts. Once the experts left, the plant reverted to previous practices.

The plant was sold a few months later to a private owner who was very interested in the potential economic benefits of implementing Cleaner Production. Cleaner Production efforts were reinstituted, and the resulting savings surprised everyone. The new owner saw the potential benefits and the links between market competitiveness and Cleaner Production.

For more information about Cleaner Production in China, contact the UNIDO/UNEP NCPC, Ning Duan, at: ningduan@cerl-pek.unep.net

continued

« "Untold stories" continued

Czech Republic

Sustained Cleaner Production requires changes in management outlook and strategy.

This story concerns implementation of Cleaner Production in a medium-sized galvanizing shop where the Czech Cleaner Production Centre had carried out on-the-job training.

The metal finishing field is well known for its Cleaner Production potential, e.g. through good housekeeping and simple operational changes. Significant benefits can also be obtained through improving employee health and safety.

When the Cleaner Production Centre visited the plant two years after initial training, they were told by management and some of the people trained that none of the options had been implemented and that Cleaner Production efforts had not continued. However, after a visit to the shop floor, it was found that the previously identified Cleaner Production options had been implemented by shop floor personnel. These personnel were motivated to make the changes because Cleaner Production options improved the quality of the worker environment and reduced their workload.

There are a couple of lessons to be learned. First, an untold story can be an untold story within the enterprise itself. That is, what is not measured or reported does not exist on an official level. Second, the impacts of Cleaner Production are often not easy to verify. In this case, there had been significant improvements but they could not be traced to Cleaner Production practices. The third lesson, perhaps the most instructive, is that Cleaner Production can result in tangible improvements, often quite quickly, but the concept has real value and long-term staying power when it is adopted by management. In this case, Cleaner Production was considered a one-time audit as opposed to an improvement/change in management outlook and strategy.

Cleaner production audits, as part of a process, must be applied (and measured) on an ongoing basis and the rationale behind them adopted by the involved stakeholders – most notably top management.

For more information about Cleaner Production in the Czech Republic, contact the UNIDO/UNEP NCPC, Ms. Anna Christianova, at: christianova@cpcz.

Other topics

Backfilling requirements and constraints in Indian opencast mining

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Summary
Most mining in India takes place in ecologically sensitive areas. The findings of a research project on backfilling (i.e. filling the pit with extracted materials) are discussed. In some cases the use of backfilling may have to be rejected, partially or completely, due to technical constraints. There are also a number of cost considerations. A national reclamation strategy for land on which mining has taken place is essential.

Résumé
En Inde, la plupart des mines sont situées dans des régions écologiquement sensibles. L'article analyse les conclusions d'un projet d'étude sur le remblayage des mines (remplissage des galeries souterraines par les matériaux extraits). Dans certains cas, le remblayage est partiellement ou totalement exclu à cause des contraintes techniques. Plusieurs considérations liées aux coûts interviennent également. Il est essentiel d'élaborer une stratégie nationale de remise en état des sols dans les anciennes régions d'exploitation minière.

Resumen
En la India, gran parte de la actividad minera se desarrolla en áreas vulnerables desde el punto de vista ecológico. Se presentan las conclusiones de un proyecto de investigación sobre rellenado (se rellena la perforación con material extraído). En ciertos casos puede resultar conveniente no autorizar el rellenado, total o parcialmente, debido a restricciones técnicas. Es necesario considerar también ciertas variables de costos. Es fundamental contar con una estrategia nacional para recuperación de suelos en áreas de explotación minera.

The most important of India's major resources is land (that is, soil, water, and associated plants and animals that make up the total ecosystem). Meeting food, energy and many other needs depends on maximum utilization of this resource. Since India has about 15% of the world's population but only something like 2.5% of its land resources, the pressure on land is obvious. Per capita availability of land declined from 0.9 ha in 1951 to 0.5 ha in 1980-81 and is predicted to be 0.26 ha by the end of 2001.

Along with other natural and anthropogenic reasons for land degradation (e.g. relentless pressure of increasing human and cattle populations, reckless exploitation of primary resources by contractors, and dam, irrigation, river valley and various other industrial projects), mining has contributed to the gradual depletion of agricultural, forest and pasture land. These impacts are associated with the increasing demand for fossil fuels and minerals during the last four decades.

The total land area leased for mining coal, lignite and other minerals is around 0.75% of India's

total land area of 304 million ha. Pits and overburden dumps (i.e. dumps of excavated dirt and rock that lay between topsoil and coal) occupy around 0.2% of the total land area and 3.2% of total cultivable wasteland. These figures look insignificant when compared with the 175 million ha of land in India that has been degraded to various degrees. However, the percentage of the total land area disturbed by mining is considerably higher than in more advanced countries like Australia (coal: 0.0038%, metal: 0.0058%, non-metal: 0.0038%) or the United States (coal: 0.069%, metal: 023%, non-metal: 0.069%) (Bell, 1986).

Land degradation due to mining

The problem of land degradation caused by mining needs to be looked at seriously *first* on account of the intensive local effects. Most mining in India takes place in forests (e.g. iron, manganese and chromite mines in Orissa; coal and limestone mines in Andhra Pradesh, Madhya Pradesh and Maharashtra; coal, copper, mica and bauxite mines in Bihar), fragile Himalayan areas (e.g. high-grade limestone, magnesite and rock phosphate mines), tourist areas (e.g. iron ore mines in Goa), regulated coastal zones (e.g. sandy beaches in Orissa, Tamil Nadu and Kerala; silica sand in Goa and Maharashtra) or intertidal zones where there is live coral (e.g. calcareous sand deposits of Jamnagar). Most of India's coal, fire clay and china clay lies under good agricultural land in West Bengal, Bihar and Orissa.

In absolute terms, the effects of local land degradation (and thus the loss of areas where mining takes place) is alarming, especially when future needs are taken into account (Choudhuri, 1995). The coal industry currently renders about 500 ha of land biologically unproductive every year. This is in addition to areas that are already derelict due to earlier activities. It is anticipated that by 2005 some 1500 ha per year will be degraded as a result of coal sector activities (Sachdev, 1995). One study has shown that coal mining in the past generated 1728 ha of void land and that another 2120 ha now lies under overburden dumps (CMPDI, 1986).

Second, land degradation is considered to result from increasing dependence on surface mining, which produces some 73% of total coal mined. With respect to Coal India Ltd. (CIL), which is responsible for 88% of the country's total coal production, surface mining's share is still higher at 77%. When the coal industry was nationalized in 1973, coal production from CIL's surface mines was only 16.4 Mt. This figure had increased about 20 times by 1999. Around 70% of the additional land required by the coal sector is for surface mining. Current lignite production of 24 Mt/year is entirely by surface mining. In the non-coal sector, total production is about 225 Mt/year, of which as much as 97% is by continuous surface mining. Production of some important minerals (e.g. iron ore, limestone, bauxite, dolomite, gypsum and magnesite) is exclusively by surface mining. With further mineral price increases and technological developments in the near future, surface mining of deposits with an even higher waste to ore ratio may become economically feasible.

The current production level of about 225 Mt/year of ores and minerals generates 270 Mt/year of wastes; production of 305 Mt/year of coal and 24 Mt/year of lignite produces 1128 Mt/year of wastes. In the future, with increased emphasis on surface mining and the greater depth of surface mines, the rate of waste generation will grow in the coal and metalliferrous sector.

The existence of value added land resources where mineral ore occurs, as well as the increasing share of opencast mining and the proportionate increase in waste generation, make it imperative for maximization of backfilling to be given priority in India's mining industry.

Legal requirements

The Mineral Conservation and Development Rules 1988, the Mineral Concession Rules 1960 and the Metalliferrous Mines Regulation 1961 are the main pieces of legislation that contain preventive and remedial measures against land degradation in mining areas in the non-coal sector. Detailed provisions for phased restoration, reclamation and rehabilitation are contained in Rule 33(4), Rule 33 (5) and Rule 34 of the Mineral Conservation and Development Rules 1988.

The Forest (Conservation) Act, Forest Conservation Rules, Mines and Minerals (Regulation and Development) Act, Mineral Concession Rules and Mineral Conservation and Development Rules provide for the regulation of mining to protect loss of vegetation and compensatory afforestation. Approval of the conversion of forest land for non-forest purposes is required under the Forest (Conservation) Act.

Legal requirements regarding backfilling are markedly lenient when compared with those of more advanced countries.

Constraints on backfilling

Geo-mining conditions with respect to ore deposits vary widely in India. Several factors affect the feasibility of backfilling, or the success of backfill-oriented post-mining land use. Factors that could technically preclude backfilling are discussed below. In some cases backfilling is technically feasible, but the efforts or costs incurred would be wasted due to other conditions that make the intended post-mining use of backfilled land (agriculture, forestation, etc.) impossible or cost-intensive.

Factors affecting technical feasibility

When the ore body/seam dips at a steep angle (>30° with horizontal), backfilling is totally discouraged or practised only partially (IBM, 1995). In some cases a safe distance has been maintained and a barrier (boulder in mud) erected. However, if the angle is very steep, keeping overburden materials in position becomes difficult. In the case of coal seams, lignite and limestone (i.e. sedimentary deposits), less effective space is available for accommodating overburden when the angle is steep.

The international market price of some minerals (e.g. chromite, lead-zinc) can vary frequently and abruptly. Since in mining the break-even depth is economically determined, price changes affect the break-even point. Backfilling can therefore be risky from the economic point of view.

Waste rock associated with certain minerals is not waste in the true sense of the word. These minerals contain a smaller amount of the same or a different mineral, whose beneficiation is not economical using technology now available in India. However, they could be useful in the future if better technology is available. Once backfilling of these value added wastes occurs, the possibility of further mineral extraction at a later date vanishes since the cost would be prohibitive (Samanta, 1989). The Indian Bureau of Mines (IBM) has issued a directive requiring that this value added overburden/interburden be stored separately. A few examples of application for value recovery, or of the potential for value recovery, include:

- nickel recovery from nickeliferrous laterite waste dumps at chromite mines in Sukinda, Orissa;
- reworking of scrap and undersized mica wastes from earlier dumps;
- use of iron ore fines, millions of tonnes of which were once rejected and have accumulated;
- separate mining of oxidized copper ore in the Malanjkhand copper mine's tailings pond, which is subjected to acid leaching for copper recovery;
- recovery of phosphate concentrate tailings from Maton; and
- recovery of scheelite from gold tailings at the Kolar gold field mines and Hutti gold mines based on the beneficiation technique developed.

In the case of a few coal and bauxite projects, the general extraction angle (with rises, dips) has been found to cause the backfilling problem. However, at deep mines with sufficient lateral extensions of deposits along the strike, it may be possible to locate internal waste dumps for dipping and steeply dipping deposits if the bottom-most economical pit depth is reached. Internal waste dumping and ore mining can be carried out concurrently provided a sufficient area is available for doing so safely.

For a few other coal projects, backfilling has not been envisaged since an underground mine exists or is proposed beneath the pit. A thorough technical study concerning underlying rock masses, their strength, etc. is a prerequisite for backfilling planning. If the parting (i.e. layers of material between the seams of coal) is insufficient and/or the rock mass is not strong enough, the dead weight of the backfilled mass may subside and the underground work zone cave in.

Cost considerations

Backfilling is the basis for improving post-mining land use, but the process of delayed backfilling adds a substantial fraction of unproductive costs (in India, about 60% of total environmental costs) to the pithead cost of the mineral. Economic returns from improved post-mining land use are almost totally lacking in India. In today's competitive mineral market, environmental benefits translated into economic terms, etc., have remained within the area of interest of researchers and educators only. The fact remains that profit margin decreases appreciably when delayed backfilling is carried out. With concurrent backfilling,

however, the cost is generally almost the same as that of external dumping, which must be practised otherwise.

It is easier for the unproductive costs of higher priced minerals such as chromite (48-50% Cr_2O_3 at Rs 2400/tonne) and manganese (46-48% Mn at Rs. 3145/tonne) to be absorbed. Such cost-intensive backfilling and other reclamation measures are not planned for a mine where the market price of the mineral (kyanite, fire clay, soapstone, etc.) is too low to sustain the extra unproductive cost. Government incentives may be required in such cases.

Other factors also tend to increase reclamation costs to a limiting extent, and sometimes make backfilling unsuitable even if it is technically feasible. The presence of a toxic sub-surface layer, while not noted in coal-bearing areas, is not uncommon in metal mining, especially in mining of chromite and lead-zinc. In other cases, the topsoil may not contain adequate nutrients to support vegetation, e.g. in lignite-bearing areas in Neyveli.

Alteration of strata during backfilling, or selective placement of overburden to bury toxic materials at a depth where they will be harmless, and/or a productive layer at the top, are suggested practices (Ammons and Perry, 1979). However, selective placement of overburden does not facilitate concurrent backfilling as temporary storage is required. Temporary storage, rehandling the overburden, more machine time, and delays in execution make selective placement of overburden cost-intensive and therefore unattractive economically. Selective placement increases backfilling costs by 15-25%.

Backfilling is not popular at mines in arid zones. Costs due to backfilling are wasted in most cases, as backfilled land cannot support any vegetation. To some extent surface manipulation of the backfilled area is possible, as well as contour harvesting for plantation/agriculture (Sauer, 1978). But again these practices involve substantial additional costs. They are not carried out anywhere in India.

Where ore is found near the surface or as outcropping, much less overburden material is generated (lower stripping ratio), e.g. in the case of Indian iron ore mining. Transporting overburden from a distant mine entails a prohibitive cost burden. In most cases, since similar geological formations exist nearby, the availability of sufficient overburden material is doubtful.

Conclusions

Although it is accepted that backfilling possibilities and techniques are unique to individual projects, development of generalized national reclamation policy for the Indian mining industry has become essential. A detailed nationwide database, together with successful examples from abroad, should form the basis for a study concerning the formulation of a reclamation strategy.

Legal requirements in the mining industry and provisions for subsidies, etc. could be based on the recommendations made following this study. Backfilling may be completely or partially dispensed with owing to one or more of the technical constraints discussed above. Where there are cost factors, provision of governmental assistance may be considered.

External costs of reclamation should be internalized, to account for the total amount spent on land reclamation.

Backfilling concepts for restoring Approximate Original Contour (AOC) should be integrated into mining planning. AOC stipulations, which currently do not exist in Indian mining regulations, should not be stringent with respect to restoring the exact pre-mining contour. Scientific studies are needed in order to fine-tune methodologies for post-mining land-use planning.

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Tourism Focus

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Soft mobility: making tourism in Europe more sustainable

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Summary

Tourists are increasingly aware of the negative impacts of traffic (including noise and other types of pollution). Heavy traffic can affect destinations' recreational or other values. For profit-oriented destination managers, the relationship between transport options and visitors' level of satisfaction and desire to return is growing in importance.

Résumé

Les touristes sont de plus en plus conscients des impacts négatifs de la circulation automobile (notamment le bruit et d'autres formes de pollution). Une circulation intense peut remettre en cause la valeur des sites touristiques, quelle que soit leur vocation (loisirs ou autre). Pour ceux qui sont responsables de sites touristiques à but lucratif, le lien entre les différentes options de transport, le degré de satisfaction des visiteurs et leur désir de revenir est d'une importance croissante.

Resumen

Los turistas son cada vez mas conscientes de los efectos negativos del tránsito (provocados incluso por ruidos y otros tipos de contaminantes). El tránsito pesado puede afectar el valor de esparcimiento y otras virtudes de los destinos de vacaciones. Para directivos de destinos vacacionales orientados a ganancias, la relación entre las opciones de transporte y el nivel de satisfacción de los visitantes y su deseo de volver está ganando importancia.

Over 50% of total passenger traffic in Europe is associated with leisure/tourism activities. The negative effects of this traffic vary according to the type of transport involved. Less than 10% of European tourists use public transport to reach their destinations. On short holiday breaks, 80% use their own vehicles. Travel during longer holidays is mainly by car (48%) or plane (47%).

Deciding whether to use public transport involves factors such as travellers' resources and the choices made by friends and family. The attractiveness of the public transport available is, of course, another factor.

Soft mobility

"Soft mobility" describes the effort to change people's habit of using private motor vehicles to one using public transport. The word "soft" suggests two important aspects: higher quality, and greater sustainability.

While soft mobility has only become a popular concept with respect to tourism during the last couple of years, studies have demonstrated increasing visitor dissatisfaction with traffic solutions at tourist destinations. Today the problems tourists want to escape (e.g. stress, noise, bad smells) increasingly follow them on holiday. The negative impacts of traffic therefore have an important influence on the choice of destination.

Soft mobility also has the aim of increasing the public's acceptance of measures taken to reduce traffic locally.

What makes soft mobility successful?

Generally speaking, a holiday is a collection of small experiences, each of which contributes to its success or failure. The success of implementing soft mobility in tourism is guaranteed if it makes possible an uncomplicated and comfortable journey using public transport, with unlimited mobility upon arrival. Such a journey would include door-to-door luggage service, optimized connection times, and acceptable prices.

In many cases, travellers are unaware of alternatives to private motor vehicle use. Better information campaigns are therefore needed.

NETS: a European tourism network

An EU model project on "Soft Mobility in Tourism Destinations" was carried out between January 1996 and July 1997. Twelve destinations and six expert organizations from Austria, Germany and Italy participated.

This model project was behind the founding of **NETS (the Network for Soft Mobility in European Tourism)**. With support from NETS, experience gained in the EU project will be disseminated and implemented within the tourism industry.

NETS was officially founded by the six foundation partners (see below): the Association for Soft Mobility, the Association for Car Free Tourism in Spa Destinations, the Car Free Tourism Destination Association, FUTOUR, Trafico, and the OAR-Regional consultancy.

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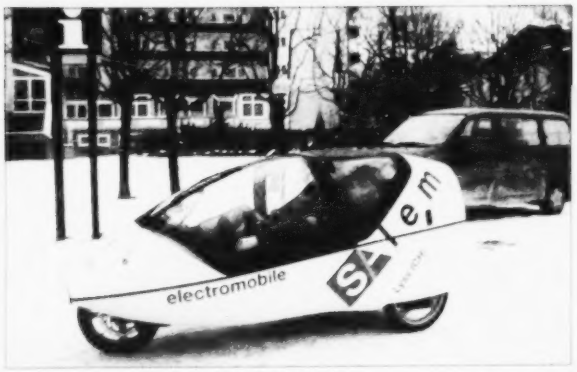

Electromobile

Velotaxi

Soft mobility in Werfenweng, Austria

NETS is based on cooperation between different partners. These include partners at a destination (e.g. local tourist boards), external partners (e.g. networks, platforms, public enterprises, ministries, NGOs) and others, as well as project leaders. For the first time, partners representing tourism, traffic and the environment have been linked within a European tourism network.

NETS emphasizes traffic and tourism concepts intended to reduce traffic's negative impacts. Among the ways soft mobility can be encouraged are: creating pedestrian zones and cycling paths, increasing public transport at a destination and during journeys, and promoting use of low-polluting cars. The public benefits since, *inter alia*, pedestrians and cyclists gain additional rights, public transport is expanded, and stress is reduced for both visitors and local inhabitants. Use of emission-free or low-emission vehicles ensures a better quality of life, as does banning vehicles with internal combustion engines from cities, city centres or recreation areas.

The activities of the network partners are supported by exchanges of know-how concerning development and implementation of sustainable traffic initiatives. Information exchange is based on viable concepts and practical experience with planning, logistics, marketing and finance.

NETS also places a great deal of emphasis on marketing. Market-specific holiday packages such as "Holiday from the Car", and multilateral marketing research to clearly define target groups, have been developed. Other NETS projects are also being planned, such as research to determine tour operators' attitudes to soft mobility in general; analysis of the components of existing products and services; and proposals for improving soft mobility products and services.

France

AFIT

The Agence Française de l'Ingénierie Touristique (AFIT) is one of the main NETS partners. Established in 1993, AFIT is a public development agency operating under the authority of the French Ministry of Tourism. Its principal mandate is to improve and develop French tourist services in all sectors (ranging from costal, rural and urban tourism to culture and mountain sports). The agency is situated between governmental authorities and private structures.

The activities of AFIT experts include providing technical assistance to local authorities and companies in the form of multi-disciplined teams. For the sector "environment and nature" (within work on sustainable development) soft mobility has assumed an important role in performance analyses and the design or implementation of tourism master plans and projects.

To address problems of motor vehicle use at French tourist destinations, the Ministries of Tourism and Environment decided to launch a programme to increase public awareness, in cooperation with the local authorities. A study on quality identified traffic growth as an important area. Decision-makers involved with tourism are aware of the problems. They are asking for effective solutions to improve the environment and the competitiveness of the tourism business.

In view of the concerns identified, the Ministries of Tourism, Transport and Environment have initiated several actions, led by AFIT experts, to develop and apply the concept of soft mobility. Naturally, the economic interests of local authorities and tourism companies make it necessary to demonstrate the advantages of alternative transport systems with respect to improving tourist journeys and the local inhabitants' quality of life. A clear distinction between actions in the tourism and transport areas is impossible.

In this context, the methods proposed by AFIT are based on a 1996 French law (PDU, Plans de Déplacements Urbain) whose purpose is to protect cities from increasing air pollution by developing strategies to promote public transport systems. The PDU's guidelines, originally for urban areas with a population of 100,000, are also relevant and worth consideration for smaller tourist destinations that experience tourist influxes.

Moreover, exchanges on practical know-how and real experience in other European countries, carried out by AFIT in cooperation with other countries and NETS, can lead to activities being undertaken to meet the needs of different stakeholders.

AFIT experts have directed the following projects:

- publication of a guide on practical experience and best practice in Europe, as a tool for local authorities and tourism actors (*Les Cahiers de l'AFIT – Guide de savoir-faire : Circulations douces. Organiser les déplacements dans les sites touristiques*, Paris, 2000, ISBN 2-910388-57-3);
- organization of a workshop in May 2000, attended by national and international experts, with visits to several projects at La Rochelle (see below);
- provision of assistance and advice to destinations developing "soft mobility" action plans.

Over the last few years, projects and research carried out by NETS and AFIT members and partners have led to a range of new initiatives focusing on soft mobility.

The main French initiatives

French initiatives for reducing the negative impacts of motor vehicle and air traffic have included:

- the high-speed train network, and improvement of connections with ski resorts and seaside resorts on the Atlantic and Mediterranean;
- promotion of public transport, especially with respect to mountain destinations;
- creation of cycling paths on the Atlantic coast and along the main rivers (e.g. the Loire and Rhône);
- provision of "park-and-ride" systems in cities and at heritage sites, including the possibility of seasonal shuttles.

Integrating the needs of inhabitants and tourism stakeholders is of basic importance in the development of acceptable sustainable action plans that promote soft mobility.

Making high-speed trains more competitive

Trains currently appear to be the least polluting means of public transport. Their competitiveness, however, depends on several factors: speed, frequency, regularity, comfort and price.

For 20 years, the French SNCF (Société nationale des chemins de fer français) has made great efforts to increase the high-speed train network. In June 2001, the Mediterranean TGV, which takes only three hours to go from Paris to Marseilles, was put into ser-

vice. During this huge project, much work was carried out to protect the landscape, and to limit noise and other nuisances for those living near the tracks.

Surveys have shown that 60-90% of travellers prefer the train to the plane for journeys of three hours or less. Thus, airline companies stand to lose hundreds of thousands of passengers per year to the new Paris-Marseille line alone. New high-speed train projects will continue to connect Paris with other cities in France and throughout Europe.

Strasbourg: soft mobility benefits visitors and inhabitants alike

Strasbourg is the regional capital of Alsace. To keep this national and international tourist destination attractive, and to improve quality of life in the historic city centre, the traffic plan was completely modified during the last several years:

- Construction of two new tramlines has been of central importance. They connect the central pedestrian zone, suburbs, railway and airport stations, and park-and-ride lots outside the centre.
- Private motor vehicle use in the city centre is restricted; crossing it in the morning and at night is possible for inhabitants, delivery services and the handicapped. There are a limited number of parking spaces in the centre and the fees are high. The park-and-ride system includes a free shuttle service.
- A bike rental service is available near public transport stations (tramway, bus, train). An electric tourist train connects sites of interest.

La Rochelle and the Ile de Ré: cycling and other alternative forms of transport

La Rochelle, in Normandy, is at the centre of an agglomeration of 120,0000 inhabitants. Every year there are 3 million visitors. Since 1985, the "Autoplus" service has offered a wide range of alternative means of transport. These now include:

- 150 cars and 100 scooters, all electric, in self-service;
- in addition to the traditional bus, two electric seabuses which cross the harbour;
- 300 bicycles for rent, four bicycle parking areas with luggage service, and 100 km of cycling paths;
- day pass tickets for bicycles and all other public transport.

The bridge connecting La Rochelle and the Ile de Ré, despite the amount of the toll and the pressure of traffic, has contributed to an increase in the number of island tourists. The Ile de Ré is overcrowded: there are 10,000 residents and 100,000 visitors per day in high season (about 6 million nights per year).

For the last ten years, the tourist office has centred its communications on the benefits of cycling and has planned many cycling tracks connecting villages, harbours and beaches. There are almost as many bicycles as cars. During the summer, the paths are crowded and there are many accidents.

Some of the island's elected representatives are considering imposing a carrying capacity to limit the number of visitors. In some villages (e.g. Saint-Martin) the pressure is so great that retailers and professionals are studying a new way to organize traffic, with variable hours, extension of the pedestrian zone, limiting motor vehicle and bicycle access to the centre, and eliminating visitor parking outside the city.

Austria
IG-sanfte mobilität

In Austria, two NETS destinations – Werfenweng and Badhofgastein – are the basis of the Austrian model project on "Soft Mobility – Car Free Tourism".

The project's objectives are to create a high-quality "car free tourism" product, implement innovative traffic concepts for travelling to the model communities, keep vehicles with internal combustion engines out of city centres, encourage use of innovative transport technologies, and improve environmental quality.

Badhofgastein, one of the ten most tourism-intensive communities, focused on "soft tourism" earlier than many other destinations. The first pedestrian zone in Austria, created in 1972, imposed a 30 km/hour zone in most of the village, with traffic prohibited at night except for inhabitants, deliveries only by vehicles up to 7.5 tonnes and only on certain days, and (since 1990) support for public transport systems. The Gastein Super-Ski Ticket (in existence for some time) guarantees the use of all lifts as well as many types of public transport.

Werfenweng, about 45 km south of the city of Salzburg, has been designated by the Austrian Ministry of Environment as a model community for soft mobility in terms of traffic and tourism. The first step has been to reduce the number of streets and rebuild the community centre. The major part of "Werfenweng – Soft & Mobile" is the section called "Arrival Logistics". The findings of this project helped to create a soft-mobile holiday package and led to the foundation of a group of tourism establishments focusing on "Holiday from the Car". This "special interest group" rewards soft and mobile behaviour by their guests with concrete and exclusive advantages. In cooperation with train companies, a door-to-door luggage service and free transportation from the railway station to the hotel are offered.

Visitors arriving in Werfenweng by train or leaving their car keys at the local tourist board receive a card allowing free use of electro-mobiles, electro-bicycles, electro-scooters and fun-riders. In addition, the night bus and taxi service can be used at no charge. To request a taxi, each family is provided with a mobile phone. Another offer was designed for train users. Those using public transport pay – at the end of their visit – only as much as they consider it was worth.

In 1997, 13 tourism enterprises in Werfenweng received awards for guaranteeing a special service available to train users (transfer, information on mobility within the hotel, discount on train tickets, etc.). Having created a "soft and mobile" offer, Werfenweng is now emphasizing staff training. Employees of hotels or the local tourist board are being taught how to promote the soft and mobile offer and influence tourist behaviour towards use of public transport.

The impulse given to the entire region of Pongau by this model project can be seen in specific examples. For example, the Bischofshofen IC/EC station has become a "vacation train station" and a "mobility centre for tourism". It coordinates the local mobility offer and functions as an information centre for questions regarding local mobility.

Switzerland
GAST – Association for Car Free Tourism Destinations in Switzerland

Since 1988, nine Swiss villages have formed the Association for Car Free Tourism Destinations in Switzerland. This association's goal is to position car free tourism as a high quality product. A ban on vehicles with internal combustion engines, as well as a general speed limit of 15-20 km/hour for electro-bikes, electro-cars and electro-taxis, helps to ensure a relaxed atmosphere and preserve the natural surroundings.

Saas Fee

SGU, the Swiss Association for Environmental Care, promotes (together with the Gemeindenetzwerk Allianz in den Alpen) a project called "New Mobility". In February and March 2000, the project was presented to people travelling from the cities of Basel, Bern and Luzern to Saas Fee. The pilot aimed to address the two main reasons for not using public transport: complicated handling of luggage, and limited mobility at the destination. The New Mobility campaign offered various advantages for tourists, including transport of luggage free of charge (following the example of airlines), a low-cost door-to-door luggage service, extension of local public transport and a low-cost car rental offer. The results of the project show the possibilities of sustainable mobility management: 8% of "New Mobility customers" switched from using their own car to using the train.

In addition to the New Mobility offer, Saas Fee features (in cooperation with Dutch tour operators) an all-inclusive package including hotel, transportation, and ski ticket.

Germany
IAKF – Association for Car Free Tourism and Spa Destinations

The Association for Car Free Tourism and Spa Destinations was founded in 1993, in order to reduce noxious emissions in German spa resorts by keeping city centres clear of motor vehicles with internal combustion engines. Twenty-eight resorts belong to this association. Results of implementing the new traffic concepts showed that, for example, in Oberstdorf (one of the member villages) motor

vehicle traffic fell by half within two years. Bad Reichenhall emphasizes cooperation with the German Railway; the tourism board is allowed to sell train tickets and reserve seats.

Uhldingen-Mühlhofen – Environmental Audit

Uhldingen-Mühlhofen on Lake Constance (Bodensee) attracts about 5 million visitors a year. It was one of the first communities in Europe to carry out a voluntary Environmental Audit. A major part of this project is concerned with sustainable mobility. Planned activities include an environmentally friendly bus shuttle to major attractions and expansion of the train station towards becoming a service centre for guests (including a bicycle rental service, park-and-ride, a car-sharing offer and a travel agency). To increase acceptance of public transport by tourists and local inhabitants, Uhldingen-Mühlhofen is organizing for the second time a car free day in the village centre and a mobility fair presenting alternative means of transport.

Netherlands
NS Travel: The Alpen Express

The Alpen Express is a train (run by the company NS Travel) that caters only for tourists who want to spend their holidays in the Alps. It operates during the winter and is equipped with a service carriage, bar carriage and couchette cars. During the winter season of 1999/2000, over 22,000 tourists used this service, representing 100% capacity.

Other examples

Other examples of soft mobility projects are listed on the "ECO-Tip" home page *(www.ecotip.org)*.

Conclusion

Traffic associated with tourism and leisure activities has been increasing at above average rates. The negative side effects (e.g. traffic jams, air pollution and noise) are reducing the attraction of many tourist destinations. Since traffic volume is predicted to rise, sustainable traffic management will be crucial to these destinations' success. In the long term, destinations that fail to implement sustainable traffic solutions will lose out.

Within the scope of Austria's EU Presidency, a European Forum for Sustainable Mobility in Tourism took place at Badhofgastein in 1998. This meeting resulted in some recommendations concerning future traffic management:

- The principles of sustainable development should be implemented through traffic, tourism and environmental policies. The basis of these policies ought to include the Kyoto targets, the EU Environmental Action Programmes and Strategy of Integration, the Convention of the Alps, and national environmental plans;
- Realistic financial conditions are needed, such as internalization of external costs (costs due to the health and environmental effects of accidents, air pollution, noise, climate impacts, etc.);
- There is a need to change to optimal technologies and alternative means of transport, with reduced emissions;
- Quality can be increased through implementing environmentally friendly mobility, providing high value to the destination with regular quality checks.

Supported by the EU and national, regional and local organizations, numerous holiday destinations have already made considerable efforts towards finding solutions to their traffic problems.

For more information, see www.soft-mobility.info (site in English and German) or e-mail: contact@soft-mobility.com.

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World News

Arab environment ministers call for new commitment to sustainable development

Ministers responsible for environment in Arab countries have endorsed a wide-ranging set of commitments intended to ensure that economic development in their countries does not take place at the expense of the environment. The Abu Dhabi Declaration emphasizes the relationship between poverty and environment, and the threat posed to natural resources by unsustainable development. The Declaration was issued in the context of the United Arab Emirates Environment 2001 Conference and Exhibition on 4-8 February, the largest environmental conference ever held in the Arab world.

"Two basic challenges must be met," says the Declaration. "First, the relentless increase in population is a major long-term threat as long as the present rates of increase are maintained and the present imbalances in population density ... continue. Second, the limitation and deterioration of most natural resources in the Arab countries must be addressed."

The Declaration was adopted following endorsement of *Outlook for Environmental Action in the Arab World*, a report that resulted from a UNEP initiative. This report was prepared with support from the United Arab Emirates and UNEP.

The ministers highlighted five major environmental issues facing Arab countries:

- severe lack of adequate water resources, in terms of both quantity and quality;
- land shortage and deterioration of available land;
- unsustainable natural resource consumption;
- rapid rates of urbanization; and
- deterioration of coastal and marine areas, with resulting fisheries and biodiversity losses.

Emphasizing the importance of enhanced cooperation with UNEP, the ministers called on UNEP to provide further support to the Council of Arab Ministers Responsible for the Environment. In this context they recognized the need to support the Environment Fund, enabling UNEP to sustain its regional and global programmes.

Noting that Arab countries have relatively few environmental specialists, and young institutions which face difficult and complex challenges, the ministers called for capacity building through education, continuing institutional development, and improvements in the quality of scientific research institutions. They also affirmed the need to enable civil society organizations to participate more effectively in environmental decision-making, so as to assure effective support for implementation, with greater emphasis on the role of women and the family.

"It would be a waste of effort, time and resources to try to address the consequences of environmental degradation without dealing with the causes," the ministers stated. "In some serious cases, there may be a need to address both simultaneously." They agreed that modern environmental economics techniques should be used by decision-makers to compare the costs of investing in environmental protection with the long-term costs of ignoring the environmental dimension in development planning.

The importance of adopting Cleaner Production (i.e. sustainable use of natural resources, exclusion of hazardous material inputs, maximization of efficiency of design and production methods, and minimization of emissions, effluents and wastes in production) was also stressed.

A unified Arab document on the state of the environment is expected to be ready in time for the World Summit on Sustainable Development in 2002. Mostafa Tolba, head of the task force that produced the *Outlook* report (and a former Executive Director of UNEP), said this SOE document would provide the first comparable environmental database on the entire Arab world.

Tolba, who heads the International Center for Environment and Development in Egypt, pointed out that coordination among regional and subregional institutions will be essential if Arab countries are to reverse the deterioration of their natural resources in coming decades.

For more information, contact: Majed Ali Al Mansouri, Head of the Scientific Committee, Environment 2001 Conference and Exhibition, Tel: +971 2 693456?, Fax: +971 2 681?357, E-mail: kbadawy@erwda.gov.ae, Internet: www.enviro2001.com. ◆

OLADE releases two major Latin American/Caribbean energy reports

Energy production in Latin America and the Caribbean declined in 1999 and demand rose by 0.5%, according to the latest *Energy Report of Latin America and the Caribbean* from the Organización Latinoamericana de Energía (OLADE, or the Latin American Energy Organization). The Quito-based body has also issued a report on *Energy and Sustainable Development in Latin America and the Caribbean: Guide for Energy Policymaking*.

Primary energy supply increased in countries including Argentina, Chile, Cuba, Grenada and Trinidad and Tobago. It fell in, for example, Colombia and Ecuador (due to lower oil or coal production) and Barbados and Jamaica (where imported oil products were substituted for crude oil). The region's natural gas sector continued to develop significantly and electricity generation capacity increased. The share of renewable sources in primary energy supply shrank slightly as firewood use declined. The *Energy Report* also includes a section on "Forecasting 2000-2020."

The *Energy and Sustainable Development* report results from a project being carried out by OLADE, the UN Economic Commission for Latin America and the Caribbean (UNECLAC) and the German Technical Cooperation Agency. It focuses on energy industry changes following economic reforms by countries in the region, using case studies to examine how energy policies contribute to sustainable development. The purpose of this report is to present the basic elements needed for energy policy identification, in order to support sustainable development. Despite improvements in the functioning of energy systems, the report emphasizes that major energy policy challenges remain, especially with respect to social and environmental dimensions.

For more information, contact: OLADE, Ave. Mariscal Antonio José de Sucre, N5-863 & Fernandez Salvador, San Carlos Sector, PO Box: 1711-06413, Quito, Ecuador, Tel: +593 2 598122/598280/597995, Fax: +59 2 531691, E-mail: olade@olade.org.ec, Internet: www.olade.org.ec. ◆

Eart Policy Institute to support "eco-economy"

Lester R. Brown, the founder and Chairman of the Board of the Worldwatch Institute, has announced the creation of a new Earth Policy Institute. He cited three rationales for the institute:

"First, we are losing the war to save the planet. Many battles have been won, but the gap between what we need to do to arrest the environmental deterioration of Earth and what we are doing continues to widen. Somehow we have to turn the tide.

"Second, we need a vision of what an environmentally sustainable economy – an eco-economy – would look like ... and a continual assessment of progress in this effort. Our goal is to help develop a shared vision of the eco-economy.

"Third, to achieve these goals, we need a new kind of research organization – one that produces brief pieces that are designed for use by the media, can be read by busy policy-makers and can be easily distributed on the Internet."

The Earth Policy Institute will disseminate three main products: a book called *Eco-Economy: Building an Economy for the Earth*, a series of four-page *Earth Policy Alerts*, and brief *Eco-Economy Updates* identifying major milestones or setbacks

on the way to an eco-economy. The book will give a picture of the new economy, how it would work, and how it can be built. *Earth Policy Alerts*, short analyses of environmental issues, will go to editors and reporters worldwide. The monthly *Eco-Economy Updates* will examine new initiatives that further or impede progress towards an eco-economy.

For more information, contact: Lester R. Brown, President & Sr. Researcher, Tel: +1 202 496 9290, E-mail: lesterbrown@earth-policy.org; or Dianne Saenz, Director of Communications, Tel: +1 202 496 9290, extension 16; E-mail: dianne@earth-policy.org; or Earth Policy Institute, 1350 Connecticut Ave., NW, Suite 403, Washington, D.C., 20036, USA. Tel: 1+2004969290, Fax: 1+200 496 9325, E-mail: epi@earth-policy.org, Internet: www.earth-policy.org. ◆

East Africa joins global initiative to save coral reefs

Four coral reefs – located in the Seychelles, Madagascar and Kenya – have been chosen for development as "centres of excellence" for reef management. This pioneering initiative was announced by researchers associated with UNEP and the Kenya Wildlife Service (KWS). Over a period of four years, the reefs will be become models of best practice for protecting and managing reefs to benefit local people, wildlife and tourists.

The four reef systems are the St Anne Marine Park and the Cousin Island Marine Protected Areas in the Seychelles, the Nosy Atafana Marine Park in northeastern Madagascar, and the Malindi-Watamu Marine National Parks in Kenya. It is hoped that lessons learned at these demonstration sites will be useful for other reef systems in the region, such as the Dar es Salaam Marine Reserve system in Tanzania.

The East Africa project is part of the International Coral Reef Action Network (ICRAN), which recently received US$ 10 million from the United Nations Foundation. An additional US$ 20 million is needed for the worldwide ICRAN programme.

UNEP DTIE plays a leading role in the International Coral Reef Information Network with respect to tourism-related activities.

For more information, please contact: Nick Nuttall, Media Officer, UNEP, PO Box 30552, Nairobi, Kenya, Tel: +254 2 623084, mobile: +254 0 733 632755, E-mail: nick.nuttall@unep.org; or Tore Brevik, UNEP Spokesman/Director, Communications and Public Information, also in Nairobi, Tel: +254 2 623292, Fax: +254 2 623927, E-mail: tore.brevik@unep.org, Internet: www.icriforum.org. ◆

UNU obtains ISO 14001 status

United Nations University (UNU) in Tokyo has achieved ISO 14001 certification after spending nearly two years setting up and running its environmental management system (EMS). The International Organization for Standardization's ISO 14001 standards on environmental management tools and systems address the way companies manage their day-to-day operations in terms of their impact on the environment.

The results of the EMS at UNU's Tokyo campus include reduced resource consumption and general improvement in staff's environmental awareness. This year UNU is taking steps to increase local public understanding of its policies and objectives related to ISO 14001. It is also working to share its experience with other parts of the UN system.

For more information, contact: Brendan Barrett, Fellow, UNU/Institute for Advanced Studies, E-mail: barrett@ias.unu.edu, Internet: www.unu.edu/ISO14001.

New version of energy and GHG analysis software

The Stockholm Environment Institute-Boston Center has released LEAP2000, the latest version of its Long-range Energy Alternatives Planning software. LEAP is a tool for integrated energy-environment and greenhouse gas mitigation analysis. It is intended for use by researchers, NGOs and government agencies. Earlier versions have been used by over 200 organizations in some 60 countries.

LEAP2000 includes a Technology and Environment Database with descriptions, technical characteristics, costs and emissions related to a wide range of energy technologies, including those concerned with energy efficiency and renewable energy. The database can be used alone or within LEAP2000 to calculate emission profiles of energy scenarios. LEAP2000 users can also conduct greenhouse gas mitigation studies and integrated assessments of energy and environmental policies and measures.

The software, which uses a Windows interface, is available on-line and is free to both non-profit and governmental organizations in developing countries. The LEAP web site *(www.seib.org/leap)* features an evaluation version that can be downloaded without charge. The site offers technical support, as well as training exercises in English and Spanish.

For more information, contact: Charlie Heaps and Michael Lazarus, SEI-Boston/Tellus Institute, 11 Arlington Street, Boston, MA 02116-3411, USA. Tel: +1 617 266 5400, Fax: +1 617 266 8303, E-mail: leap@tellus.org. ◆

Czech Republic: a better environment and quality of life

Through a combination of broad public support, adequate funding, stringent legislation and effective work by environmental institutions created since 1989, the environment and quality of life in the Czech Republic improved dramatically in the 1990s, according to a new report by the Charles University Environmental Center.

Czech Republic 2000, Ten Years On: Environment and Quality of Life after Ten Years of Transition summarizes the most notable changes in the country's overall well-being during the decade. It cites improvements in air pollution emissions, ambient air quality, water supply and quality, and waste management, among other environmental indicators. In addition, quality of life indicators such as improved nutrition and increased life expectancy point to rapid convergence with EU countries.

In a section on responses to environmental challenges, the report documents the legislative and institutional framework developed over the past several years. However, the issue of sustainable development is not considered to have been adequately addressed yet in any widespread fashion, remaining of concern mainly to academics and NGOs.

The report covers international environmental cooperation, development assistance, the country's pending accession to the European Union, and other international issues. It notes that the environment is regarded as one of the most difficult areas in the accession process. Steps being taken as part of preparations for EU accession are outlined.

For more information, contact: Charles University Environmental Center, U Krize 8, 158 00 Prague 5, Czech Republic, Tel: +420 2 51080202, Fax: +420 2 5610441, E-mail: czp@czp.cuni.cz, Internet: www.czp.cuni.cz.

Industry Updates

Indian firms increasingly take environment into account

The Delhi-based Tata Energy Research Institute (TERI) has reported an increasing trend among major Indian corporations to make environmental considerations an important part of how they do business.

The following examples were cited:

- The Indian Government has announced that all power plants are to undergo eco-rating. TERI, which will carry out the process, described this as "the green equivalent of a credit rating system." Some big companies such as Indian Oil Corporation have already had eco-ratings performed. The rating could be a first step towards ISO 14001 certification.
- Over 40 top companies per year, on average, get energy audits at TERI. To date, more than 150 companies have been audited. Major five-star hotels and building complexes have recently joined the trend. India's proposed Energy Efficiency Bill seeks to make energy auditing mandatory.
- Several leading companies have formed a network called the Corporate Roundtable, or CoRE. The members – 16 enterprises so far – meet to identify key problem areas in the field of industrial sustainability and develop strategies to address them. Issues discussed have included reuse of water effluent from oil drilling, waste use in kiln operations, water audits for corporate facilities, and electro-floatation for treatment of oily effluent.

TERI has undertaken India's first survey on environmental management practices among leading corporations, based on voluntary disclosures. Of the approximately 50 companies that responded, more than 60% reported that they had ISO certification. The findings suggested, however, that information exchange among corporations is poor.

For more information, contact: Venkat Sundaraman or Uzam Amar Mishra, Communication Services, TERI, 2001, Darbari Seth Block, Habitat Place, Lodhi Road, New Delhi 110 003, India. E-mail: venkats@teri.res.in or uamishra@teri.res.in. Internet: www.teriin.org. ◆

Asia-Pacific Roundtable for Cleaner Production meets in the Philippines

Some 360 participants from 28 countries discussed the current and future status of Cleaner Production in the Asia-Pacific region at the third meeting of the Asia-Pacific Roundtable for Cleaner Production (APRCP), which took place in Manila on 28 February-2 March 2001.

UNEP and APRCP released a new joint report, *Status Report: Cleaner Production in Asia-Pacific 2000*, at the meeting (see book reviews below). UNEP, APRCP and the Singapore-based Regional Institute for Environmental Technology (RIET) also held a parallel three-day workshop on ISO 14001 for small and medium-sized enterprises. The UNEP/FIDIC ISO 14001 training kit was presented at this workshop, as was UNEP IETC's training package on ISO 14001 for urban management.

The workshop, which was considered a great success, will be repeated in the Philippines later this year. UNEP and APRCP also collaborate in other areas, such as the launching of APRCP's Youth Action programme. The session of the APRCP meeting on CP financing was coordinated by UNEP DTIE's Ari Huhtala.

APRCP, a regional forum for information exchange on CP and mutual support for CP activities, is an independent non-profit organization registered in the Philippines. UNEP has acted as adviser to APRCP since its founding in 1997, when the first regional roundtable on CP (which took place in Bangkok) concluded that such a forum was needed. APRCP is governed by a Board of Directors (current members come from 12 countries and four international organizations). Its Secretariat is hosted by the Thailand Environment Institute in Bangkok.

APRCP intends to take a more active role as a regional CP project clearinghouse in the region. The next APRCP meeting is planned for September 2002 in Indonesia.

For more information, consult APRCP's web site (www.aprcp.org.ph) or contact: Niclas Svenningsen, UN Economic and Social Commission for Asia and the Pacific, United Nations Building, Rajadamnern Nok Avenue, Bangkok 10200, Thailand. Tel. +66 2 288 1234, Fax: +66 2 288 1000, E-mail: svenningsen.unescap@un.org. ◆

Sustainable coffee production in Mexico

Mexican farmers are carving a niche for shade-grown, fairly traded coffee in the booming international specialty coffee market, according to a report by Equiterre, a Montreal-based NGO. Small-scale coffee producers are employing fair trade practices that involve forming cooperatives and exporting directly to foreign buyers. Because the farmers typically grow their coffee under the shade of forest canopies, usually without using agro-chemicals, their activity helps preserve local biodiversity.

The report, *Coffee with a Cause*, says this coffee production represents sustainable development in action. It was published with financial support from the North American Fund for Environmental Cooperation, the fund of the North American Commission for Environmental Cooperation established by the NAFTA environmental side accord to build cooperation among Canada, Mexico and the United States in protecting their shared environment.

For more information, contact Christine Larose at NAEC (clarose@cec.org, Tel.: +1 514 350 4321) or Isabelle Vallières at Equiterre (ivallieres@equiterre.qc.ca, Tel: +1 514 522 2000 (extension 22). ◆

Hybrid-electric buses perform best

A study by the Northeast Advanced Vehicle Consortium (NAVC) in the United States has found that existing hybrid-electric and natural gas buses produce less emissions in real driving conditions. The study compared conventional diesel buses with newer, cleaner buses in "real world" urban driving cycles, to see if emissions from hybrid-electric and natural gas buses were significantly lower in stop-and-start conditions. The buses were also tested with different types of fuel to measure particulate emissions.

Compressed natural gas (CNG) buses performed best in terms of particulate emissions, which were about 80% lower than those of traditional diesel buses, and emissions of nitrogen oxide (NO_x), which were 50-60% lower. But hybrid buses running on low-sulphur gasoline seemed to perform best overall, with a combination of lower emissions of carbon monoxide (CO) (70% lower than those of a traditional diesel bus), NO_x (30-40% lower) and particulates (90-70% lower), as well as better mileage than either the conventional diesel bus or the CNG model.

For more information, contact: Sheila Lynch, Executive Director, NAVC, 112 South St., Fourth Floor, Boston, MA 02111, USA, Tel: +1 617 451 1770, Internet: www.navc.org. ◆

Certifying social responsibility for SMEs

Current and former employees of the corporate advisory giant KPMG have taken a recently formed company – which certifies corporate social responsibility (including environmental practices) – public. GoodCorporation is a London-based firm whose services are especially aimed at small and medium-sized enterprises (SMEs), which it says are often put off by the amount of bureaucracy involved in certification.

GoodCorporation has drawn up a 21-point charter covering responsibilities to employees, customers, suppliers, the community and environment, and shareholders. To be certified, a

company must undergo an independent audit. The first ten recipients of GoodCorporation certification ranged from Ladbrokes, a major bookmaker owned by Hilton, to an independent hotel-restaurant.

ARM Holdings, a UK-based international microprocessor technology firm which received certification, said it underwent the audit because institutional investors were putting increasing pressure on companies to meet strict standards of corporate responsibility.

For more information, contact GoodCorporation, 37 St John's Hill, Battersea, London SW11 1TT, UK. Tel: +44 207 924 3994. Fax: +44 207 924 7000. E-mail: info@goodcorporation.com, Internet: www.goodcorporation.com. ◆

TotalFinaElf revamps environmental policy towards sustainability

The oil group TotalFinaElf has adopted a sustainable development strategy, following in the footsteps of the Shell and BP groups. Introduced to some 250 upper-level managers in April, the strategy has gradually been made public since. It has five main elements: optimizing hydrocarbon resource use; reducing greenhouse gas emissions; improving product energy efficiency; developing renewable sources; and integrating company operations in the local environment.

According to CEO Thierry Desmarest, the *Erika* oil spill off the coast pf Brittany in December 1999 was not behind the change, which originated in separate moves by Total, Fina and Elf before the three European companies merged in February 2000. "We realize we're behind Shell and BP, but we're not the last to act," Desmarest said. "We're ahead of ExxonMobil."

For more information, contact: Communications Department, TotalFinaElf, 2 place de la Coupole, La Defense 6, 92400 Courbevoie, France. Tel: +33 1 47 44 45 46. Fax: +33 1 47 44 78 78. ◆

Research on financial institutions and the Kyoto Mechanisms

A Swiss university institute, a US-UK emission broker, an Italian bank and a German insurance firm have joined forces to conduct research on financial institutions' contributions to use of the Kyoto Mechanisms. The aim is to develop innovative financial products tailored to meet the needs of participants in greenhouse gas emission markets and prospective Kyoto Mechanisms users.

The University of St. Gallen-IWOe, the Gerling insurance group's sustainable development arm, SanPaolo Imi, and Natsource-Tullett Europe will examine how various policy scenarios and market structures affect pricing of emission permits. They will explore the scope for private sector insurance against financial risks associated with the Kyoto Mechanisms, and adapt project finance approaches to take the implications of emission trading into account. The group will also analyze how to build efficient portfolios of commercial climate protection projects that take advantage of risk-diversification potential, and determine what type of private sector investment funds for such projects would best generate marketable emission permits.

The group plans to derive policy recommendations from the findings. The results will be applied to concrete cases, mostly in Europe and the Mediterranean, and be disseminated through reports, workshops and conferences. The project is scheduled for completion by September 2002.

For more information, contact: Olaf Arndt, scientific coordinator, IWOe-HSG, Tigerbergstrasse 2, CH-9000 St.Gallen, Switzerland. Tel: +41 71 224 258 7. Fax: +41 71 224 27 22. E-mail: olaf.arndt@unisg.ch; or Dirk Kohles, administrative-financial coordinator, GSDP, Kaiser-Wilhelm-Ring 7-9, DE-50672 Cologne, Germany. Tel: +49 221 144 7549. Fax: +49 221 144 7666. E-mail: dirk.kohles@gerling.de. ◆

UNEP Focus

UNEP's Governing Council: calls for increased funding, more action

"We do not need new priorities or new visions. What we need to do now is to implement," Klaus Toepfer, UNEP's Executive Director, opened the 21st session of the UNEP Governing Council and second Global Ministerial Environment Forum in Nairobi, Kenya, in February with this call to action. He also underscored the need for more funding of UNEP's programmes. "Give us a basis for our work. But please give us that basis with more resources," he urged.

Toepfer's words picked up on an earlier statement by two members of the UNEP Youth Advisory Council, Shalala Oliver Sepiso (Zambia) and Nanako Mizuno (Japan), who called for implementation of policies rather than more meetings and negotiations. They stressed the link between poverty, overconsumption and the environment.

This Governing Council session was attended not only by environment ministers from over 80 countries, NGO representatives and young people from around the world, but also (for the first time) by lawmakers.

Among the results of the session:

- Ministers approved UNEP's 2002-2003 work programme and budget of nearly US$ 120 million. However, Toepfer stressed that UNEP needs additional financial support to carry out the ambitious work programme. He said it is vital to broaden the donor base and secure reliable contributions. The European Union is responsible for 60% of UNEP's core funding. Toepfer thanked Northern European countries, the United States and Canada for their support. He said he would work to encourage other countries, including those in the Arab world, to contribute more to UNEP's work.
- UNEP will undertake a global study on the health and environmental effects of mercury. This study, which will also assess the cost-effectiveness of mercury anti-pollution measures and technologies, is to run through 2003.
- Among several decisions on UNEP's chemicals agenda was a new initiative to tackle the issue of lead in petrol, and one aimed at encouraging countries to ratify the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. UNEP committed itself to develop a new global chemicals strategy, with potential restrictions on heavy metals being the highest priority.

Both Toepfer and the session President, Canadian Environment Minister David Anderson, highlighted the growing importance of the Internet and telecommunications in raising environmental awareness. UNEP has launched unep.net, a "one-stop" web-based service whose purpose is to transform the way knowledge about the environment and environmental degradation is disseminated (see Web Site Highlights, page 94).

The importance of communications was vividly demonstrated by means of a satellite link between the session and Sir Peter Blake's research vessel, *Seamaster*, off the Antarctic Peninsula. Sir Peter told Toepfer and the ministers present in Nairobi: "We are in an area that normally is solid ice at this time of year." *Seamaster*, flying the UNEP flag, was at 71° South. Sir Peter linked the disappearance of ice in this area to global warming.

As a side event at the Governing Council session, a Global Compact meeting brought together members of the business community, trade unions and NGOs. The Global Compact is an initiative of Kofi Annan, the UN Secretary-General, who has challenged businesses to incorporate human rights, labour and environmental principles into individual corporate practices and into their lobbying for public policies.

The Governing Council concluded this session with an agreement to establish an open-ended intergovernmental group of ministers, or their representatives, to examine how to strengthen international environmental governance and UNEP's funding as part of the lead-up to the World Summit on Sustainable Development (Rio +10) in Johannesburg in 2002.

Official documentation from this Governing Council session is available on *www.unep.org/GC_21s*.

For more information, contact: Tore Brevik, UNEP Spokesman, Tel: +254 2 623292, or Robert Bisset, Tel: +33 1 44 37 76 13, E-mail: robert.bisset@unep.fr. For information about the Global Compact, see www.unglobalcompact.org ◆

New Director of UNEP's Regional Office for Africa

Klaus Toepfer, UNEP's Executive Director, has appointed Sekou Toure of Côte d'Ivoire as Director of UNEP's Regional Office for Africa effective 1 February 2001. Toure formerly worked for the Government of Côte d'Ivoire as High Commissioner for Hydraulics, Special Adviser to the State Minister in Charge of Development Planning, and Special Adviser to the Prime Minister. He provided extensive technical assistance on a wide range of environmental issues and projects, and on matters related to international negotiations.

Toure has had research and teaching experience in the United States as well as in Côte d'Ivoire. He holds a Ph.D. in civil engineering (specializing in environmental engineering) from the University of New Hampshire.

For more information, contact: Cristina Boelcke, Director, Division of Regional Cooperation, UNEP, Tel: +254 2 623517, Fax: +254 2 624270, E-mail: cristina.boelcke@unep.org ◆

Stockholm Convention on POPs signed

Diplomats from around the world gathered in Stockholm in May to sign the Stockholm Convention on Persistent Organic Pollutants (POPs). The new Convention, one of many important initiatives growing out of the 1992 Rio Conference, is the international community's most ambitious effort yet to reduce and ultimately halt proliferation of toxic chemicals.

While earlier chemicals treaties have relied on notification requirements or end-of-pipe controls, the Stockholm Convention calls for outright bans and destruction. It is designed to eliminate or severely restrict production and use of 12 pollutants, including pesticides and industrial chemicals; ensure environmentally sound management and chemical transformation of POPs waste; and prevent emergence of new chemicals with POPs-like characteristics.

Four common characteristics of POPs make them particularly hazardous:

- they are toxic;
- they are persistent, resisting normal processes that break down contaminants;
- they accumulate in the body fat of humans, marine mammals and other animals, and are passed from mother to fetus; and
- they can travel great distances (typically from temperate and tropical regions to the poles) on wind and water currents. Even small quantities of POPs can injure human and animal tissue, causing nervous system damage, diseases of the immune system, reproductive and developmental disorders, and cancers.

Negotiations on the Convention were organized by UNEP. It was finalized in December by consensus of the 122 negotiating governments, with the support of chemical industry trade associations and hundreds of environmental/public health NGOs. Key elements include:

- precaution as the guiding principle;
- funding commitments enabling all countries to participate. On an interim basis, the Global Environment Facility (GEF) will serve as the principal financial mechanism;
- elimination of intentionally produced POPs, and ultimate elimination of by-product POPs; and
- environmentally sound management and disposal of POPs wastes (including stockpiles, products, articles in use, and materials contaminated with POPs).

Fifty ratifications are needed to make the agreement legally binding.

For more information, contact: UNEP Chemicals, PO Box 256, 15 chemin des Anémones, Châtelaine, CH-1219 Geneva, Switzerland, Tel: +41 22 917 8172, Fax: +41 22 797 3460, E-mail: chemicals@unep.ch, Internet: www.chem.unep.ch/pops. ◆

UNEP investigates depleted uranium sites in Kosovo

A UNEP team reports that depleted uranium (DU) used during the 1999 Kosovo conflict resulted in low levels of radioactivity. The findings suggest there has been no immediate cause for concern. However, UNEP is urging precaution, citing "a very clear need for...clean-up and decontamination of the polluted sites".

In November 2000, a UNEP field mission from the Balkan Task Force team visited 11 of the 112 sites identified by NATO as targets for ordnance containing depleted uranium. Sites were chosen based on the amount of ammunition used and their relevance with respect to the environment and to local populations. It was the first time a study of this type had been carried out on DU environmental impacts following a real conflict situation.

The international team of 11 scientists collected soil, water and vegetation samples and conducted smear tests on buildings destroyed and vehicles and DU penetrators. Remnants of DU ammunition were found at eight sites. The team sent 247 soil, 45 water and 30 vegetation samples for testing, along with a few milk samples. Also analyzed were pieces of anti-armour rounds, two penetrators, five penetrator jackets and a penetrator fragment.

Samples were analyzed for radioactivity and toxicity by laboratories in Austria, Italy, Sweden, Switzerland and the UK, with financing from the Government of Switzerland.

"Out of the 11 sites visited, the team found three sites with no signs of higher radioactivity nor any remnants of DU ammunition. At eight sites, the team found either slightly higher amounts of beta radiation immediately at or around the holes left by DU ammunition, or pieces and remnants of ammunition," said Pekka Haavisto, the former Finnish Environment Minister, who chaired the DU Assessment Team.

In addition to U-238, which makes up the bulk of DU, the penetrators contained uranium isotope U-236 and plutonium isotope Pu-239/240. The presence of these transuranic elements indicated that at least some of the DU had been in nuclear reactors. The isotopes were found only at very low levels, and no significant impact on overall radioactivity was considered to have taken place. Mild contamination from DU dust was detected near targeted sites. Bio-indicators revealed some evidence of airborne DU contamination.

No widespread ground contamination was found. While the number of contamination points in the areas investigated was high, the team said there was no significant risk of contamination of air or vegetation.

"These scientific findings should alleviate any immediate anxiety that people living or working in Kosovo may have been experiencing," UNEP's Executive Director Klaus Toepfer declared. "Under certain circumstances, however, DU can still pose risks. Our report highlights a series of

precautionary measures that should be taken to guarantee that the areas struck by DU ammunition remain risk-free."

The full report, including a map of the 112 sites and additional details, is available at *http://balkans.unep.ch* (also see page 93).

In a related development, Toepfer and Mohamed El Baradei, Director-General of the International Atomic Energy Agency, agreed to consider how to respond to requests for fact-finding missions to Bosnia-Herzegovina, the Federal Republic of Yugoslavia and Iraq, other sites where DU has been used in military conflicts. UNEP and the IAEA are coordinating their actions with the World Health Organization (which recently decided to send a team to study DU's health effects in Iraq) and other UN system organizations.

For more information, contact: Tore Brevik, UNEP spokesman, Tel: +254 2 623292, E-mail: tore.brevik@unep.org; or Pekka Haavisto, Tel: +358 40 588 4720, E-mail: pekka.haavisto@upi-fiia.fi; or Henrik Slotte, UNEP Balkans Unit, Tel: +41 22 917 8598, E-mail: henrik.slotte@unep.ch. ◆

Experts finalize global ship-breaking guidelines

In June of this year, international experts on hazardous waste and shipping began finalizing international guidelines for environmentally safe dismantling of obsolete ships, under the auspices of the Basel Convention on the Transboundary Movement of Hazardous Wastes and Their Disposal.

Although transport of hazardous wastes by sea played a part in convincing the international community to adopt the 1989 Basel Convention – there were highly publicized incidents of hazardous wastes being sent to developing and eastern European countries for dumping – it is only in the last several years that the toxic materials vessels themselves are made of have become a priority issue.

Dismantling a large vessel may entail the removal of many tonnes of hazardous materials, including PCBs, mercury, lead, asbestos, and oil and gas. It can also result in the release of dioxin and sulphur fumes. The health of workers and local communities, coastal and ocean biodiversity, and the quality of groundwater and air may be threatened.

The new guidelines seek to minimize or eliminate such risks by introducing universally applied principles for environmentally sound management of ship dismantling. Procedures and good practices are proposed for decommissioning and selling obsolete vessels, dismantling them, sorting parts (for reuse, recycling and disposal), identifying potential contaminants, preventing toxic releases, monitoring environmental impacts, and responding to emergencies and accidents. The guidelines also address the design, construction and operation of ship dismantling facilities.

Ship-breaking is labour intensive. The industry has a strong presence in several developing countries, which also provide markets for recycled parts. India breaks 42% of the vessels dismantled worldwide every year, Bangladesh 7%, Pakistan 6%, China 4%.

Concerned that practices at major breaking yards violate the Basel Convention, the EU is studying the feasibility of dismantling ships in Europe. The United States, which has prohibited the export of government-owned vessels to major breakers, is also considering using its own capacity.

The guidelines are being developed by the Basel Convention's Technical Working Group, with contributions from the International Maritime Organization (IMO), the International Labour Organization (ILO), and environmental NGOs. The plan is to finalize them by October, for adoption by the Sixth Meeting of the Conference of the Parties to the Basel Convention in 2002.

For more information, contact: Michael Williams, Tel: +41 22 917 8242, mobile +41 79 409 1528, E-mail: michael.williams@unep.ch. Or see www.basel.int and www.ilo.org/safework/shipbreaking. ◆

World Energy Council and UNEP see hope for greenhouse gas reductions

Voluntary actions by industry, governments and organizations are leading to small but significant reductions in GHG emissions, according to UNEP and the World Energy Council. WEC studies released in late June indicate that current clean energy programmes, government initiatives and renewable energy projects will save the equivalent of a billion tonnes of CO_2 annually by 2005, or more than 3% of total GHG emissions in 2000.

WEC added that a billion tonnes might well understate the savings outlook: a survey of 91 countries indicated that additional projects in the pipeline could double that figure.

Klaus Toepfer, UNEP's Executive Director, said pessimism about recent climate change discussions had obscured small but real progress towards reducing emissions. For example, China (which accounts for 14% of world CO_2 emissions) has made an "active effort to promote energy conservation, end coal subsidies, and support more efficient coal-fire power generation."

The WEC report appeared after several months of developments concerning climate change initiatives had given considerably less reason for optimism:

◆ In January, the Intergovernmental Panel on Climate Change (IPCC) released the first of three parts of its *Third Assessment Report*, confirming that evidence of human influence on the global climate is stronger than ever and projecting potentially devastating global temperature rises of 1.4-5.8°C before the end of this century.

◆ In February, a member of UNEP's Financial Services Initiative reported that global warming could cost the world hundreds of billions of dollars a year unless urgent efforts are made now to curb emissions of CO_2 and other greenhouse gases. In low-lying countries like the Maldives, the Marshall Islands and the Federated States of Micronesia, losses could exceed 10% of GDP by 2050. This report – from Munich Re, one of the world's biggest re-insurance companies – was published in UNEP's *Our Planet* magazine.

◆ In the same month, scientists from GRID-Arendal, UNEP's key Arctic research centre, warned that global warming could accelerate as rising temperatures in the Arctic melt permafrost, causing it to release greenhouse gases. It estimated that summer sea ice in the Arctic Ocean could thin by as much as 60% if CO_2 levels reach double their pre-industrial atmospheric levels. British scientists also warned that the ice in the Antarctic is shrinking.

◆ Also in February, the second part of the IPCC report ws released. It addressed expected changes in weather patterns, water resources, the seasons, ecosystems, extreme weather, and cycles of disease, famine and poverty.

◆ In March, the third part of the IPCC report was released. It examines policies and technologies for tackling GHG emissions and the threat of climate change. The report confirms that many cost-effective solutions are available, but cited institutional, behavioural and other barriers that governments would have to address if these solutions were to realize their potential. It also says the choice of energy mix and associated investments would determine whether atmospheric concentrations of greenhouse gases can be stabilized, and if so at what level and cost.

◆ In April, Klaus Toepfer urged development of a more complete picture of the roles and interactions of greenhouse gases, aerosols and ozone, after scientists associated with the Indian Ocean Experiment suggested the thick brown haze that forms over much of Asia during the tropical dry season could have profound effects on human health, crop yield and rainfall patterns. GRID-Arendal also launched an interactive on-line map to assist the Kyoto Protocol process (*http://maps.grida.no/kyoto*). The map presents data collected by international institutions. Using it, any user can evaluate current emissions and projections for the future.

◆ In May, 16 national academies of science endorsed the IPCC as the most reliable source of information on climate change and its causes in a joint statement. They called for prompt action to reduce GHG emissions. Moreover, they considered that ratification of the Kyoto Protocol is a small but essential first step towards stabilizing atmospheric concentrations of greenhouse gases.

For more information, contact: Nick Nuttall, Media Officer, UNEP, Nairobi, Kenya, Tel: +254 2 623084, mobile: +254 0 733 632755, E-mail: nick.nuttall@unep.org; or Elena Virkkala Nekbaev, Manager of Programmes, WEC, Tel: +44 207 734 5996, E-mail: nekbaev@worldenergy.org; or Taysir Al-Ghanem, WMO Spokesman, Tel: +41 22 730 8315, E-mail: Al-ghanem_t@gateway.wmo.ch.

Also see www.grida.no for downloadable graphs; www.unfccc.int for official documents concerning the climate change talks; and www.wmo.ch or www.unep.ch/conventions/info/infoindex.htm for additional background information. ◆

World Environment Day: the World Wide Web of Life

The theme of this year's observance of World Environment Day is "Connect with the World Wide Web of Life," a choice that reflects the need for each and every one of us to recognize our role in preserving our fragile planet and the ecosystems, resources and natural processes that bind us all together. More than ever, life on earth requires of us a sense of universal responsibility – nation to nation, person to person, human to all other forms of life.

Kofi Annan

Albert Einstein once said that in crisis, imagination is better than knowledge. We do need more knowledge about the world's major ecosystems and about the complex interplay between environment and development, since it is impossible to devise effective policy unless it is based on sound scientific information. That is one reason why today marks the launch, by the United Nations and the World Resources Institute, of the Millennium Ecosystem Assessment, an international collaborative effort to fill important knowledge gaps and to map the health of our planet.

At the same time, we know more than enough already to face the hard choices ahead. We already have the technical skills to halt destructive trends and to place our economies on a more sustainable footing. It is not knowledge and scientific research, but political and economic factors, that will determine whether or not the wisdom accumulating in our labs and libraries will be put into practice. Challenges such as climate change, desertification, the destruction of biological diversity and population growth are testing not only our imagination, but also our will.

Sustainability is in everybody's interest, rich and poor alike. One in every two jobs worldwide – in agriculture, forestry and fisheries – depends directly on the sustainability of ecosystems. Yet unsustainable practices are woven deeply into the fabric of modern life. And myths have taken hold suggesting there is little alternative to these short-sighted and wasteful patterns of consumption and development. So let us, on this World Environment Day, connect with a new ethic of global stewardship and conservation, and most of all with the imagination and courage to make it a reality.

Kofi A. Annan
Secretary-General of the United Nations

World Environment Day: message from UNEP's Executive Director

World Environment Day 2001 had as its slogan "Connect with the World Wide Web of Life." The Executive Director of UNEP, Klaus Toepfer, called this "a reminder that the Earth with all its complex, interlocking ecosystems is the foundation of our lives." At celebrations in Turin, Italy, he evoked the "puzzling combination of promise and threat" posed by the new millennium.

"The riches of the information age are being felt by all of us – from the Internet, the internationalization of trade, to the inconceivable breakthroughs in medical science," he said. "But despite the profits and promise of globalization our old problems are enduring – and urgent. We contemplate the looming threats of inequalities brought about by the forces of globalization, poverty, reduced food security, the intricate balance between population, resources and the environment, the challenge of sustainable development and the relationship of all these to the future of humanity and the environment."

The Earth, Toepfer said, is "our common heritage". He drew a parallel between the World Wide Web and the "vast web of interconnected species and systems that fit together in intricate ways, enabling the whole system to continue. There are limits to how much our population can grow, and how much we can alter our surrounding environment, without causing changes that will reverberate throughout that web and jeopardize our own future."

Toepfer called for "a fundamental change in the way we meet our needs and a reassessment of what those needs really are," adding that governments cannot do the job alone. "We need every individual citizen to help ensure strong environmental protection. Joining together is not a matter of choice – it is a necessity."

To mark World Environment Day, UNEP presented its Global 500 Awards for 2001 to 18 individuals and organizations. They include a husband and wife team from Malaysia who have rescued over a quarter of a million turtle eggs, a Kenyan children's doctor who almost single-handedly transformed an old quarry into a nature reserve, an American company specializing in ecotourism, and a Canadian teenager who began to fight pesticide misuse at the age of ten.

For more information, contact: Nick Nuttall, Media Officer, UNEP, Nairobi, Kenya. Tel: +254 2 623084, mobile: +254 0 733 632755, Fax: +254 2 623692, E-mail: nick.nuttall@unep.org

UNEP Division of Technology, Industry and Economics (DTIE) HIGHLIGHTS

Energy entrepreneurship in Africa

With support from the United Nations Foundation (UNF), African energy entrepreneurs will expand their efforts to deliver clean, modern, affordable energy to poor rural areas of Africa and South America. UNF is investing US$ 4.2 million in UNEP's African Rural Energy Enterprise Development initiative (AREED) and will begin a similar programme in Brazil. This is in addition to the Foundation's initial US$ 2 million AREED investment in 1999.

AREED's goal is to nurture a new type of entrepreneur in Ghana, Botswana, Mali, Senegal and Zambia by delivering commercial expertise and modest amounts of start-up financing. Over 30 enterprises are being developed to deliver affordable energy services based on clean, renewable energy sources. It is working with a Ghanaian company that processes and sells cereal and tuber food products. The company plans to use solar crop dryers to meet increased production targets, with a small capital investment loan from AREED and assistance in producing a full business plan for bank co-financing.

UNEP DTIE's Energy Group in Paris administers AREED, which began in early 2000. AREED provides early-stage funding and assistance in leveraging financing from conventional sources, as well as training and hands-on business development assistance. It also helps local development and finance organizations build long-term rural energy enterprise expertise. AREED works with African NGOs to identify potential energy projects and coordinate business support services for entrepreneurs, and with financial institutions to assess the rural energy business sector and integrate it into their loan and investment portfolios.

Part of AREED's success is due to on-the-ground partnerships with organizations such as the US-based E&Co (a pioneer in providing "patient" investment capital to energy enterprises in developing countries) and ENDA, a development organization based in Senegal.

Recent expansion of this initiative to Brazil will help provide clean and affordable energy to the 20 million rural Brazilians without access to modern energy services. As in the case of AREED, the Brazil Rural Energy Enterprise Development (BREED) programme links access to energy services with the broader aims of sustainable development – especially for women and children, who often bear the greatest burden from dependence on traditional fuels.

For more information, contact: Eric Usher, Energy Programme Officer, or Mark Radka, Programme Coordinator, at UNEP DTIE, in Paris. Tel: +33 1 44 37 14 50, Fax: +33 1 44 37 14 74, E-mail: unepie@unep.fr, Internet: www.uneptie.org; or Xiaodong Wang, Programme Officer for Climate Change, United Nations Foundation. Tel: +1 202 887 9040, Fax: +1 202 887 9021, E-mail: xwang@unfoundation.org

Opening of the Finance, Mining and Sustainability conference in Washington

Methyl Bromide Communication Programme makes use of NGO expertise

UNEP and representatives of ten environmental and agricultural NGOs have launched a joint initiative to raise methyl bromide awareness in ten developing countries. This pesticide is a hazardous ozone-depleting substance.

The Methyl Bromide Communication Programme is the first project under the Montreal Protocol where funds have been provided to utilize the expertise of NGOs in phasing out ozone-depleting chemicals. The NGOs have presented approaches for reaching farmers and other pesticide users, including organization of workshops with users, meetings with government officials, and development of media strategies.

The NGOs will carry out communication programmes in their countries, relying on the strategies and recommendations agreed at the meeting. Lovemore Simwanda, Director of the Environmental Conservation Association of Zambia, called the initiative "a unique partnership between UNEP and local organizations that allows us to teach and educate local farmers and take action on this toxic pesticide."

"UNEP is pleased to be working in close partnership with NGOs to promote the phase-out of methyl bromide and the adoption of alternatives," said Jacqueline Aloisi de Larderel, Director of UNEP's Division of Technology, Industry and Economics. "By leveraging NGOs' expertise in grassroots organizing, these awareness-raising activities will play an important role in helping countries achieve the 2002 freeze and phase-out requirements for methyl bromide."

For more information, contact: Corinna Gilfillan, OzonAction Programme, at UNEP DTIE in Paris. Tel: +33 1 44 37 14 71. Fax: +33 1 44 37 14 74. E-mail: corinna.gilfillan@unep.fr. Internet: www.uneptie.org/ozat/info/partnership/home.htm

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UNEP announces global telecommunications alliance

UNEP joined the International Telecommunication Union to celebrate World Environment Day by announcing an alliance called the Global e-Sustainability Initiative, or GeSI. Its aim is to improve the global environment and support sustainable development by promoting business practices and technologies that save energy, minimize waste, and help bridge the "digital divide".

GeSI brings together some of the world's biggest information and communications technology companies and their industry associations. Both operators and suppliers have made a commitment to manage their business operations in an environmentally friendly way, and to promote sustainable business practices and technologies around the world.

Companies joining the initiative must meet criteria showing they have reached a certain level of environmental achievement. They commit to sharing experience, working with stakeholders, managing operations sustainably, raising awareness of the contribution their industry can make to society, and carrying out research and benchmarking.

For more information, contact: Corine Van der Lugt at UNEP DTIE in Paris. Tel: +33 1 44 37 14 39. Fax: +33 1 44 37 14 74. E-mail: corine.lugt@unep.fr.

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Joint conference on finance, mining and sustainability

Leaders of institutions that finance many of the world's main mining projects met in Washington in April to analyze key issues facing the mineral industries, and the role of financial institutions in the transition to a more sustainable development model.

The conference on Finance, Mining and Sustainability was sponsored by UNEP, the World Bank and the Mining, Minerals and Sustainable Development Project. At the Bank's headquarters the approximately 125 participants were addressed by its President, James Wolfensohn, and the Director of UNEP DTIE, Jacqueline Aloisi de Larderel, among other speakers. Topics included the need for clearer understanding of interactions between the finance industry and the mining and minerals sector, the low capital returns and risks of catastrophic loss in the sector, and the extent to which improving economic, environmental and social performance can lower risk and increase returns.

A report on an earlier mining-related event has been published, *Environmental Regulation for Accident Prevention: Tailing and Chemicals Management*, available in booklet form or on CD-

ROM, summarizes the proceedings of a workshop organized in Perth in October 2000 by UNEP and the Government of Australia. The purpose of this workshop was to discuss ways to improve the effectiveness of regulation as a means of preventing mining accidents. It was the first major international exchange on accident prevention by mining regulators. Experts and regulators from about 20 countries participated.

For more information, contact: the Mining, Minerals and Sustainable Development Project, E-mail: mmsd@iied.org; or the Mineral Resources Forum – Environment, Internet: http://mineralresourcesforum.unep.ch; or Fritz Balkau at UNEP DTIE in Paris, Tel: +33 1 44 37 14 39, Fax: +33 1 44 37 14 74, E-mail: fritz.balkau@unep.fr. ◆

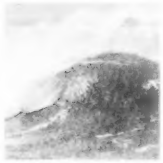
New UNEP Finance Initiatives newsletter

The UNEP Finance Initiatives (UNEP FI), administered by DTIE's Economics and Trade Unit, has launched a new quarterly newsletter with a provocative title: *0.618...*

The reference is to the "golden" mean or ratio, found in shapes and patterns throughout nature, which has been called "nature's way of building quantity without sacrificing quality." Topics covered in the first 16-page issue, which appeared on 1 June, include UNEP FI's April conference in Manila, "The Financial Sector in Asia-Pacific: The Business Case for Sustainability Performance"; the workshop on North America hosted by Citigroup in New York, also in April; and UNEP FI activities in preparation for the Rio + 10 summit next year.

For more information, contact: Paul Clements-Hunt, editor UNEP Finance Initiatives, 15 chemin des Anémones, CH-1219 Châtelaine, Geneva, Switzerland Tel: +41 22 917 8178, Fax: +41 22 796 9240, E-mail pch@unep.ch, Internet: www.unepfi.net

0.618...



UNEP FI on the road to Rio+10

Contractors and Southeast Asian leaders sign CP Declaration

Thomas Rogge, President of the Confederation of International Contractors' Associations, signed the UNEP International Declaration for Cleaner Production in February, joining more than 220 signatories representing private and public sector activities worldwide. The signing took place in Christchurch, New Zealand, at a convention of the Federation of Asia and Western Pacific Associations. The convention's theme was Construction in Partnership with the Environment.

Less than two months later, in Manila, the Philippines, several senior Southeast Asian decision-makers confirmed their support for CP by signing the Declaration at the opening session of the International Conference on Industrial Park Management, whose theme was New Strategies for Industrial Development. The signatories included Heherson Alvaraz (Minister of Environment and Natural Resources of the Philippines), Anchalee Chavanich (head of the Industrial Estates Authority of Thailand), and managers of industrial estates in the Philippines and Thailand.

For more information, contact: Fritz Balkau at UNEP DTIE in Paris, Tel: +33 1 44 37 14 39, Fax: +33 1 44 37 14 74, E-mail: fritz.balkau@unep.fr; or Niclas Svenningsen, UN Economic and Social Commission for Asia and the Pacific, United Nations Building, Rajadamnern Nok Avenue, Bangkok 10200, Thailand, Tel: +66 2 288-1234, Fax: +66 2 288-1000, E-mail: svenningsen.unescap@unep.org ◆

UNEP DTIE web sites

The following sites are either new or have new addresses. Also see Web Site Highlights on page 94.

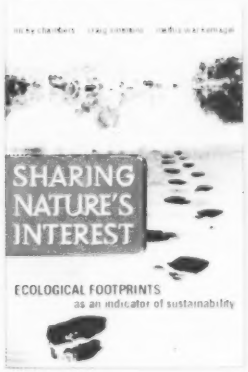
http://www.halontrader.org
http://www.uneptie.org/unido/food
http://www.uneptie.org/ozon/home.html
http://mineralresourcesforum.unep.ch
http://oef.unep.ch

Books & Reports

GENERAL

Sharing Nature's Interest: Ecological Footprints as an Indicator of Sustainability

In *Sharing Nature's Interest* the concept of ecological footprinting, introduced by Mathis Wäckernagel and William E. Rees in 1996, is refined and translated into a methodology that, according to Wäckernagel and his two new co-authors, enables individual households, complex businesses or whole cities to calculate their environmental impacts. The aim is not only to simplify calculation of the ecological footprint, but (as the subtitle emphasizes) to promote footprinting as an easy-to-understand indicator of just how sustainable – or unsustainable – various human activities are. The book is user-friendly with cartoon illustrations, Question and Answer sections, and many web site references for further information.



N. Chambers, C. Simmons and M. Wackernagel (2000), Earthscan Publications Ltd., 120 Pentonville Road, London, N1 9JN, UK, Tel: +44 20 7278 0433, Fax: +44 20 7278 1142, E-mail: earthinfo@earthscan.co.uk, Internet: www.earthscan.co.uk, Pbk., 185p, ISBN 1-85383-749-4.

Natural Capitalism: The Next Industrial Revolution

Three top consultants in the greening of business and industry make the case for proper valuation of Earth's "natural capital" as a key to major profitability gains. Focusing on specific business areas (e.g. car-making, textiles and farming) and on issues such as subsidies, waste, water use and cli-

mate change, they argue that developed countries can reduce materials and energy consumption by 90-95% without depriving people of the goods and services they want. *Natural Capitalism* also underlines the human component of nature, with section titles such as "Wasting People" and "Industry and Community."

P. Hawken, A.B. Lovins and L.H. Lovins (2000). Earthscan Publications Ltd. (see above). Pbk., 396p. ISBN 1-85383-763-6.

From Here to Sustainability: Politics in the Real World

The Real World Coalition, comprising some 25 British non-profit organizations, emphasizes the human costs of unsustainability. This is the Coalition's second report. *The Politics of the Real World* was published in 1996. Again addressed to political leaders, *From Here to Sustainability* describes several "sustainability gaps", such as the Quality of Life Gap (a "decoupling" of the economy from quality of life) and the Environmental Gap (the degree to which policies and actions fall short of what is needed to safeguard the climate or biodiversity, for example). The book outlines long-term programmes to close these gaps (urging *inter alia*, radical reform of fiscal policy, the trade system, education and the United Nations). It makes recommendations to the current UK government on short-term actions that might be taken in preparation for the World Summit on Sustainable Development.

J. Christie and D. Warburton for The Real World Coalition (2001). Earthscan Publications Ltd. (see above). Pbk., 223p. ISBN 1-85383-735-0.

Perspectives on the New Economy of Corporate Citizenship

The Copenhagen Centre (TCC) was founded by the Danish Government in 1998 to further communication between government, business and civil society, with a focus on social responsibility and inclusiveness. This is the second report from TCC's New Economy Programme, which explores the relationship between the "new economy" and development of new social partnerships. It presents several short essays on corporate citizenship and the new economy, including "Greening the New Economy" by J. Wilsdon and J. Porritt of Forum for the Future.

S. Zadek, N. Hojensgard and P. Raynard, eds. (2001). The Copenhagen Centre, Holmens Kanal 22, DK-1060 Copenhaken K, Denmark. Tel: +45 33 92 94 43. Fax: +45 33 92 92 95. E-mail: tcc@copenhagencentre.org. Internet: www.copenhagencentre.org. Pbk. 151p. ISBN 87-988161-0-1.

The Earthscan Reader in Business and Sustainable Development

This volume brings together some of the most important recent work on business implications of sustainable development. The articles and book extracts, published between 1996 and 1999, cover topics including business opportunities, environmental and social accounting, and trade and sustainable development. Among the authors are J. Elkington (on the "triple bottom line"), D. Korten ("The Responsibility of Business to the Whole"), S. Zadek (on performance, ethics and accountability) and S. Beder ("Global Spin," on the use of corporate clout to quash environmental concerns). The editors introduce each section by presenting their take on the authors' positions.

R. Starkey and R. Welford, eds. (2001). Earthscan Publications Ltd. (see above). Pbk., 364 pp. ISBN 1-85383-639-7.

Buried Treasure: Uncovering the Business Case for Corporate Sustainability

Part of the "Engaging Stakeholders" series (published by SustainAbility in collaboration with UNEP DTIE), *Buried Treasure* tackles the common assumption that sustainable development is not necessarily good for business. It analyzes the relationship between ten measures of business performance and ten dimensions of sustainable development performance. The authors conclude that evidence in favour of the business case for sustainable development is continuing to increase and is especially strong in certain business performance areas. *Buried Treasure* is designed to be used in tandem with the on-line business case resources of SustainAbility and UNEP.

(2001). SustainAbility, 11-13 Knightsbridge, London SW1X 7LY, UK. Tel: +44 207 245 1116. Fax: +44 207 245 1117. Internet: www.sustainability.co.uk. Pbk., 56p. ISBN1-903168-02-3.

The Power to Change: Mobilising Board Leadership to Deliver Sustainable Value to Markets and Society

Published with the International Business Leaders Forum, *The Power to Change* explores how and why boards of major companies, faced with issues that relate to globalization and corporate power, are starting to integrate triple bottom line considerations – economic, social and environmental – into corporate governance responsibilities.

(2001). SustainAbility (see above). Pbk., 43p. ISBN 1899159-02-9.

Sustainable Banking: The Greening of Finance

Financial institutions are increasingly aware that financing of business can be carried out in a way that stimulates firms to control their environmental impacts. *Sustainable Banking* presents the viewpoints of bankers, other financial sector actors, academics, NGOs, and additional stakeholders from around the world. Part 1 gives practical examples of environmental policy-making by banks; Part 2 discusses the importance of transparency in such policies and the role of communication; Part 3 looks at green investment funds; Part 4 is devoted to environmental risk and product innovation in banking; and Part 5 addresses the roles of governments, NGOs and multilateral banks.

J.J. Bouma, M. Jeucken and L. Klinkers, eds. (2001). Greenleaf Publishing (in association with Deloitte & Touche), Aizlewood's Mill, Nursery Street, Sheffield S3 8GG, UK. Tel: +44 114 282 3475. Fax: +44 114 282 3476. E-mail: sales@greenleaf-publishing.com. Internet: www.greenleaf-publishing.com. Hbk., 480p. ISBN 1874719381.

Globalisation and Sustainable Development: Opportunities and Challenges for the Financial Services Sector

This report summarizes the proceedings of a two-day UNEP Financial Initiatives Roundtable in November 2000, hosted by Deutsche Bank in Frankfurt. Some 260 bankers, insurers and asset

managers, along with representatives of civil society and intergovernmental organizations, met to explore how the financial services sector is adapting to the globalizing marketplace, and to stakeholder demands for more corporate responsibility related to sustainable development. Among other topics, participants discussed environmental management and reporting in the finance sector, environmental performance indicators, innovative financing for renewable energy and cleaner production technologies, and micro-financing to alleviate poverty.

(2001). UNEP Finance Initiatives, 15 Chemin des Anémones, CH-1219 Châtelaine, Geneva, Switzerland. Tel: +41 22 917 8178. Fax: +41 22 796 9240. E-mail: pch@unep.ch. Internet: www.unepfi.net. Pbk., 34p.

Environmental Policy: Objectives, Instruments, and Implementation

Though its examples are drawn mostly from the experience in the UK, *Environmental Policy* is aimed at anyone concerned with the practical design of economic instruments for implementing environmental policy. The 12 chapters, by Scott Barrett, David Pearce, Dieter Helm (the editor) and others, are divided into three parts: Principles, Policy, Sectors. In the first part topics such as sustainable development, cost-benefit analysis

and technology-based standards are addressed: in the second the Kyoto Protocol and biodiversity; and in the third the roles of energy taxation, water issues, agri-environmental policy and transport. The final chapter is devoted to the history of the UK's landfill tax.

D. Helm, ed. (2000). Oxford University Press, Great Clarendon Street, Oxford OX2 6DP. Tel: +44 186 555 6767. Fax: +44 186 555 6646. E-mail: enquiry@oup.co.uk. Internet: www.oup.co.uk. Pbk., 324p. ISBN 019-9241368.

OECD Environmental Outlook

Developed as a basis for OECD environmental strategy development, the *Environmental Outlook* analyzes prospects for natural resource use and environmental quality to 2020, as well as policy options that could change the scenario. "Traffic light" symbols are used to highlight key findings: green for a positive outlook, yellow for uncertain, red for worsening. Like the Worldwatch Insitute (see below), the OECD warns of increasing problems with groundwater pollution. Other red light findings include biodiversity loss, climate change and urban air pollution. This report covers primary sectors and natural resources: energy, climate change, transport and air quality; households, selected industries and waste; and cross-cutting issues such as the social-environmental interface and resource use efficiency.

(2001). OECD Publications, 2, rue André-Pascal, 75775 Paris Cedex 16, France. Tel: +33 1 45 24 82 00. Fax: +33 1 49 10 42 76. Internet: www.sourceoecd.org. Pbk., 327 p. ISBN 92-64-18615-8.

State of the World 2001

The 18th edition of the Worldwatch Institute's annual flagship publication cites increasing signs of environmental deterioration and considers that this visible evidence is just the tip of a melting iceberg. The deeper problem, the authors argue, is the environmental and economic threat posed by growing inequity within and between countries. Several issues are put on the table for the World Summit on Sustainable Development in 2002, including the debt crisis, food security, groundwater pollution, environmental crime, and the loss of political momentum with respect to environmental concerns. However, examples of progress are also provided. Ways are suggested by which efforts to achieve a sustainable world economy could be mobilized.

Worldwatch Institute (2001). W.W. Norton & Co., 500 Fifth Avenue, New York, NY 10110, Tel:+1 212 354 5500, Fax: +1 212 869 0856, Internet: www.wwnorton.com; www.worldwatch.org. Pbk., 275p. ISBN: 0-393-32082-0.

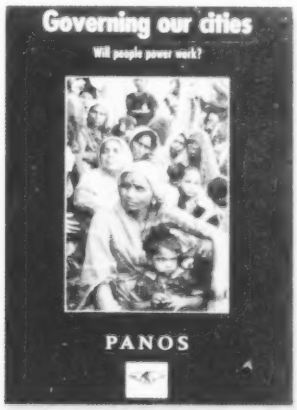
Vital Signs 2001: The Trends That are Shaping Our Future

Humans are eating more meat, drinking more coffee, popping more pills, driving further and getting fatter. Around the world they consume more than ever before. Yet over a billion people do not have access to safe drinking water. Natural disasters may have more devastating consequences than ever, and we have yet to vanquish some of the world's biggest killers (diarrhoea, malaria and AIDS). The tenth anniversary edition of *Vital Signs* presents 50 key environmental, social and economic trends, documented using thousands of government, industry and other sources. Ranging from nuclear power to pharmaceutical sales to religious environmentalism, they show how an economy geared towards meeting insatiable consumer demand can adversely affect the health of the world and its inhabitants.

Worldwatch Institute (2001). W.W. Norton & Co. (see above). Pbk., 192p. ISBN 0-393-32176-2.

Governing Our Cities: Will People Power Work?

Timed to appear five years after the Habitat II "city summit" in Istanbul, this Panos Institute report assesses whether post-Istanbul urban strategies are succeeding. It concludes that, for new approaches to succeed, governments must



work with groups in civil society, especially the poor. Integral to the discussion are issues such as urban water quality and quantity, sanitation, waste management, transport and air pollution.

(2000). Panos Institute, 9 White Lion Street, London N1 9PD, UK. Tel:+44 207 278 1111. Fax: +44 207 278 0345. E-mail: marke@panoslondon.or.uk. Internet: www.panos.org.uk. Pbk., 44p.

Improving Environmental Performance and Compliance: 10 Elements of Effective Environmental Management Systems

This guidance document is the first joint statement of its type from Canada, Mexico and the United States. It is intended to help entities that already have an Environmental Management System achieve better environmental performance, not only through assuring compliance with environmental laws but also by moving beyond compliance.

(2000). Commission for Environmental Cooperation, 393 rue St-Jacques Ouest, Bureau 2000, Montréal, Québec, Canada H2Y 1N9. Tel: +1 514 350 4300. Fax: +1 514 350 4314. E-mail: agreenson@ccemtl.org. Internet: www.cec.org. Pbk., 10p.

Shaping the Urban Environment in the 21st Century: From Understanding to Action

This reference manual, produced by the OECD Development Assistance Committee, stems from work on the environmental aspects of its 1996 *Shaping the 21st Century* report. A DAC task force, with participation by UNCHS (Habitat) and UNEP, set out to provide guidance on urban environmental issues for development cooperation agencies. The manual addresses key policy issues, includes "do's and don'ts" for donors, and recommends actions.

(2000). OECD Publications (see above). Pbk., 136p.

ENERGY

Natural Selection: Evolving Choices for Renewable Energy Technology and Policy

Energy demand has grown steadily in recent years, averaging some 2% per year in the 1990s. This new UNEP DTIE publication says energy systems developed to meet this demand so far are clearly unsustainable, as they lead directly or indirectly to health-damaging levels of air pollution, acidification of ecosystems, land and water contamination, biodiversity loss and global warming. *Natural Selection* provides an overview of major renewable energy technologies and policy frameworks that could further their development, as well as some scenarios that might lead to a sustainable energy future.

(2000). UNEP. Available from: SMI (Distribution Services) Limited, P.O. Box 119, Stevenage, Hertfordshire SG1 4TP, UK. Fax: +44 1438 748 844. E-mail: anthony@earthprint.com. Internet: www.earthprint.com. Pbk., 36p. ISBN 92-807-1968-8.

CLIMATE CHANGE/ AIR POLLUTION

Biometeorology and Urban Climatology at the Turn of the Millennium: Selected Papers from the Conference ICB-ICUC'99

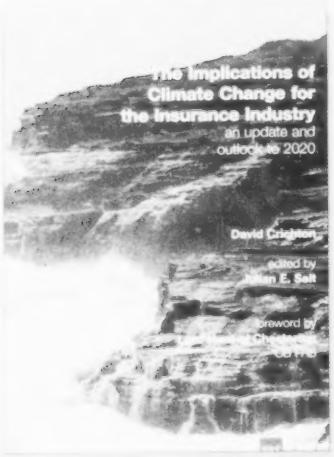
Of the 300 or so papers presented at an WMO-UNEP conference in Sydney in late 1999, around one-third were selected for inclusion in this volume. They identify a number of threats to health and well-being, both individual and collective, linked to or made worse by urbanization. These include air pollution, flooding, heat stress, spread of diseases, and climate change. Other issues highlighted include climate-related threats to food

security and the consequences of population growth, crowding and poor health care.

R.J. de Dear, J.D. Kalma, T.R. Oke and A. Auliciems (2000). World Meteorological Organization (WMO), Case postale No. 2300, CH-1211 Geneva 2, Switzerland. Tel: +41 22 730 88 11, Fax: +41 22 730 81 81, E-mail: PubSales@gateway.wmo.ch, Internet: www.wmo.ch, Pbk., 646p. ISBN 92-63-01026-9.

The Implications of Climate Change for the Insurance Industry: An Update and Outlook to 2020

This publication analyzes the likely effects of climate change on the global insurance industry by 2020. Scientific, political and economic aspects of the issue are outlined from a risk perspective, relying on the industry viewpoint. A major focus is the


The Implications of Climate Change for the Insurance Industry
an update and outlook to 2020
David Crichton
edited by
Julian E. Salt
foreword by

development of strategies to help insurers minimize future losses. This "update and outlook" includes proposals for mitigation, which are recommended to be put into effect as soon as possible.

D. Crichton and J.E. Salt (ed.) (2001). BRE, Garston, Watford WD25 9XX, UK. Tel: +44 192 366 4930, Fax: +44 192 366 4994, E-mail: salt.j@bre.co.uk, Internet: www.bre.co.uk, Pbk., 69p. ISBN 1-90385-2-00-5.

The Collapse of the Kyoto Protocol and the Struggle to Slow Global Warming

The author, a Senior Fellow for Science and Technology at the Council on Foreign Relations in New York, is a regular contributor to publications including *Foreign Affairs*, *Nature* and *Scientific American*. Despite the collapse of the November 2000 conference at the Hague, many politicians, policy-makers and analysts continue to consider the Kyoto Protocol a vital first step towards slowing greenhouse warming. Writing before the Bonn negotiations in July of this year, Victor foresees an imminent climate change policy crisis. He agrees with critics who say the Protocol is fundamentally flawed and unlikely to be implemented. But he believes its failure could present opportunities to establish more realistic alternatives.

D.G. Victor (2001). Princeton University Press, 41 William Street, Princeton, New Jersey, USA, 08540-5237, Tel: +1 609 258 4900, Fax: +1 609 258 6305, Internet: http://pup.princeton.edu/titles/7029.html, Pbk., 160p. ISBN: 0-691-08870-5.

OzonAction Strategic Information System

UNEP DTIE has released an updated version of the OzonAction Strategic Information System (OASIS) 2000, an electronic reference tool that supports compliance with the Montreal Protocol on Substances that Deplete the Ozone Layer. This CD-ROM provides developing countries with the strategic information they need to make decisions on technical and policy issues. Developed by the UNEP DTIE OzonAction Programme, under the Multilateral Fund for the Implementation of the Montreal Protocol, OASIS is an easy-to-use reference system that furnishes essential resource material related to Montreal Protocol implementation. Although it is designed primarily for National Ozone Units (NOUs), industry associations and enterprises in developing countries, OASIS 2000 is a useful information resource for anyone directly or indirectly involved in phasing out ozone-depleting substances (ODS). This version includes updated and expanded information. It features improved search options. OASIS 2000 can help users better understand how to meet the technical and policy challenges that countries, businesses and organizations face under the Montreal Protocol.

(2000). UNEP. Available from SMI (see above).

Eliminating Dependency on Halons: Case Studies

The development of safe, affordable chemical fire protection agents such as bromochlorofluorocarbons (commonly known as halons) significantly increased fire safety worldwide. But halons are an ozone-depleting substance – the first ODS phased out by industrialized countries under the Montreal Protocol. Now UNEP DTIE's OzonAction Programme has brought out a new publication in an effort to help developing countries meet the dual challenge of assuring effective fire protection and Montreal Protocol compliance. Eight examples show how countries and organizations have addressed problems of halon management. Topics range from alternatives used in sectors such as aviation, electronic facilities and the military, to how Poland established a network of stakeholders and institutions to steer its halon phase-out. Guidance is provided on key issues such as decommissioning of halon systems. Though designed for National Ozone Units within governments, this publication will also be useful to, for example, public fire services, fire equipment vendors, halon users, insurance companies, customs officials and NGOs.

(2001). UNEP. Available from SMI (see above). Pbk., 70p. ISBN 92-807-1784-7.

INDUSTRY SECTORS

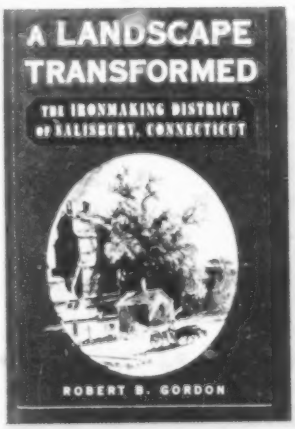
APELL for Mining: Guidance for the Mining Industry in Raising Awareness and Preparedness for Emergencies at Local Level

APELL (Awareness and Preparedness for Emergencies at Local Level) is a process for responding to accidents and disasters. It provides the elements local communities need to prepare emergency response plans in cooperation with industry and other key stakeholders. This new UNEP Technical Report describes how the APELL process applies to various types of emergencies associated with mining, such as subsidence, breaches in tailings dams and spills of toxic chemicals.

(2001). UNEP. Available from SMI (see above). Pbk., 67p., ISBN: 92-807-2035-X.

A Landscape Transformed: The Ironmaking District of Salisbury, Connecticut

R.B. Gordon, a professor at Yale University, examines the industrial ecology of a region in New England where ironmaking was a key economic activity for 200 years, starting in the 18th century. *A Landscape Transformed* investigates the cultural context in which people made decisions about



their use of technology and the environment. As the author explains, these decisions often led to surprisingly eco-friendly results.

R.B. Gordon (2001). Oxford University Press (see below). Hbk., 159p. ISBN 0-19-512818-4.

Thatcherism and the Fall of Coal

When Margaret Thatcher was elected Prime Minister in 1979, British coal mines employed over 200,000 people and produced over 100 million tonnes of coal a year. By the end of the 1990s, more than 95% of these jobs and 80% of coal production no longer existed. The author, a member of the British Government's Energy Advisory Panel, describes the industry's decline, attributing it to a combination of the Thatcherite political agenda, economic forces and the industry's own actions.

M.J. Parker (2000). Oxford University Press/ Oxford Institute for Energy Studies (see above). Hbk., 234p. ISBN 0-19-7300251.

Making a Good Catch: Non-CFC Technologies in the Fishery Cold Chain

From catch to consumer, the fishing industry relies on a "cold chain" to keep its product marketable. A common feature of many of the links in the cold chain has been the use of ozone-depleting, CFC-based refrigeration technology. With countries committed to phasing out ozone-depleting substances under the Montreal Protocol, the fishing industry is looking at new non-CFC technologies. This book, which gives examples of such technologies and their use in nine countries, includes an overview of refrigeration equipment used in the industry. It provides an introduction to alternative refrigerants and lists refrigerant data and sources of information.

(2000). UNEP. Available from SMI (see above). Pbk., 58p. ISBN: 92-807-1976-3.

WATER

The Local Government Water Code: The Lisbon Principles

Working in close collaboration with the International Council for Local Environmental Initiatives, Lisbon's city government developed a water code now known as the Lisbon Principles. The code was finalized and endorsed by Lisbon, Rio de Janeiro and Toronto during ICLEI's 10th World Congress, which took place in Lisbon in April 2000. This booklet presents the code in Portuguese, Spanish and English. Included is a model water code resolution for adaptation by local governments.

Municipality of Lisbon and ICLEI (2001). Câmara Municipal de Lisboa, Gabinete do Vereador Manuel Figueiredo, Praça do Município, 1149-014 Lisbon, Portugal. Tel: +351 21323617 4/5/6. Fax: +351 21323617 9. E-mail: ver.mfigueiredo@cm-lisboa.pt. Internet: www.cm-lisboa.pt. Pbk., 21p.

CHEMICALS, POLLUTION AND ACCIDENTS

Database on the Transport of Chemical Substances (TROCS 2001)

The latest version of this CD-ROM was developed by an IMO/UNEP collaborating centre, the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC), also in collaboration with Malta University Services. It is designed to be used by parties to the Barcelona Convention to assist decision-making in the case of marine spills. New features include an expanded listing, comprising more than 700 chemicals; new conversion tools; accident reports; and shoreline types.

(2001). REMPEC, Manoel Island, Gzira, GZR 03, Malta. Tel: +356 337296. Fax: +356 339951. Internet: www.rempec.org.

Why Poison Ourselves? A Precautionary Approach to Synthetic Chemicals

This publication argues that applying the precautionary principle, in combination with regulatory efforts, would be more effective than regulations alone in controlling persistent organic pollutants (POPs). In particular, the author examines the pulp and paper industry, pesticide production, and the manufacture of PVC plastic. In each industry, she argues, there is evidence that "detoxification" can be carried out without crippling production.

A.P. McGinn (2000). Worldwatch Institute. Tel: +1 800 555 2028, +1 301 567 9522. E-mail: wwpub@worldwatch.org. Internet: www.worldwatch.org. Pbk., 92p. ISBN 1-878071-55-6.

IPCS Environmental Health Criteria series

The International Programme on Chemical Safety (IPCS) is a joint venture between UNEP, the International Labour Organization (ILO) and the World Health Organization (WHO). The IPCS Environmental Health Criteria series provides critical reviews of potential health and environmental effects of chemicals and combinations of chemicals. They are primarily risk evaluations, based on published and unpublished studies. The documents are in English, with summaries in French and Spanish. The series is available from WHO and from WHO sales agents. The latest EHC title is:

EHC 219: Fumonisin B1 *(2000). Pbk., 150p. ISBN 92-4-157219-1.*

WHO, Distribution and Sales, CH-1211 Geneva 27, Switzerland. Tel: +41 22 791 2476. Fax: +41 22 791 4857. E-mail: bookorders@who.ch. Internet: www.who.int.

IPCS Concise International Chemical Assessment Documents

A further IPCS series, begun in 1998, presents brief summaries of scientific information on the potential human health and/or environmental effects of specific chemicals. These are based on selected national or regional evaluations, or on the Environmental Health Criteria series. Like the EHCs, they are published in English with French and Spanish summaries. Four new titles are available:

CICAD No. 23: 2,2-Dichloro-1,1,1-trifluoroethane (HCFC-123) *(2000) Pbk., 31p. ISBN 92-4-153023-5.*

CICAD No. 24: Crystalline Silica, Quartz *(2000) Pbk., 50p. ISBN 92-4-153024-3.*

CICAD No. 25: Chloral Hydrate *(2000) Pbk., 34p. ISBN 92-4-153025-1.*

CICAD No. 26: Benzoic Acid and Sodium Benzoate *(2000) Pbk., 48p. ISBN 92-4-153026-X.*

WHO, Distribution and Sales (see above).

OECD Environmental Outlook for the Chemicals Industry

The chemicals industry is an important segment of the world economy, accounting for 7% of global income, 9% of global trade and over 10 million jobs worldwide. According to this OECD report, production will be 85% higher in 2020 than it was in 1995. Non-OECD countries will have a much larger share of the market – especially in the case of high-volume commodity chemicals. The report concludes that lack of information on chemical safety, as well as on the amounts of hazardous substances being released to the environment during use or disposal, represents a major challenge to policy-makers.

(2001). OECD Publications (see above). Internet: www.oecd.org/edu. Pbk., 164p.

NATIONAL/REGIONAL

Managing for Change: Leadership, Strategy and Management in Asian NGOs

This comparative study is a result of the NGO Management Research Programme, begun in 1994 by the Aga Khan Foundation Canada. It is a synthesis of case studies of nine major South Asian non-governmental organizations in an era when NGOs in the region have been growing in size, complexity and influence. Topics covered include strategy formation, effective leadership, donor relations, staff motivation and development, and management styles for crisis and change.

I. Smillie and J. Hailey (2001). Earthscan Publications Ltd. (see above). Pbk., 193p. ISBN 1-85383-722-9.

Status Report: Cleaner Production in Asia-Pacific 2000

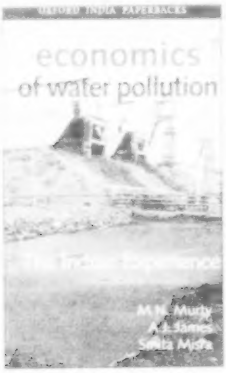
At the third Asia-Pacific Roundtable for Cleaner Production (APRCP) in Manila earlier this year, UNEP and APRCP introduced this report for use by government, industry, NGOs and others implementing or encouraging CP. It includes overviews of CP activities in the region and by

New from India

Oxford University Press has published four new environmental titles under its OUP India imprint. Three deal with specifically South Asian topics, while the fourth is more general.

Economics of Water Pollution: The Indian Experience

The authors focus on industrial pollution and the economic instruments used to control it. The result, a survey of the latest approaches to economic analysis in pollution economics, is the first such study to address the situation in



India. Its aim is to acquaint readers with theoretical and applied approaches to pollution control in developing countries, and to serve as a research text on applied environmental economics. The study relies largely on primary research; much of the material is drawn from a project on pollution abatement carried out by the authors in 1994-96. Part I, "Policy Instruments for Pollution Control", discusses the role of government and includes a survey of international practice. Part II, "Collective Action for Pollution Regulation", reviews approaches in which government's role is minimized or eliminated. Part III is concerned with environmental resource accounting.

M.N. Murty, A.J. James and S. Misra (2000). Pbk., 295p. ISBN 019-56555068.

Cleaning-Up the Ganges: A Cost-Benefit Analysis of the Ganga Action Plan

The Ganga Action Plan (GAP), one of the world's largest ever river clean-up projects, went into effect in 1985. Ten years later, with investment costs estimated at US$ 318 million and operating costs at US$ 10 million, some observers were asking whether the money had been well spent, and whether a developing country with limited public funds could run such a project successfully. The Indian Government therefore commissioned a cost-benefit analysis. The authors, representing the two main institutions involved in carrying out the study, note that such analysis has not often been applied to river system clean-up projects. The study team not only evaluated water quality improvements since 1985, but also modelled conditions that would have existed by the late 1990s had the GAP not been undertaken. They examined both user and non-user benefits in terms of health, toxicants, fisheries and biodiversity, taking into account distribution effects and ways to finance the project sustainably. They conclude that the benefits justify the project, and that practical ways exist to make the GAP financially sustainable.

A. Markandya and M.N. Murty (2001). Hbk., 300p. ISBN 019-5648451.

The Use and Abuse of Nature

This Fissured Land: An Ecological History of India (OUP India, 1992) and *Ecology and Equity* (UNRISD, 1995) are here combined in an omnibus edition. The authors, an ecologist and a sociologist, cite the uniquely human capacity for both destruction and conservation of nature. *This Fissured Land* was originally intended to fill a lacuna: lack of attention to environment by India's historians. Focusing on forests and forestry, it deals largely with the colonial period. The purpose of *Ecology and Equity* was partly to meet criticism of the first book as doom-laden, and partly as a response to what the authors perceived as general negativism among Indian environmentalists. Focusing on post-Independence India, it seeks to examine the interaction of excess and prudence in human use of natural resources. Together with a new introduction, the two books may now help guide India's environmental movement towards the use of new approaches.

M. Gadgi and R. Guha (2001). Hbk., 213p. ISBN 019 5649273.

Environmental Economics

This volume in the "Readers in Economics" series (previously published journal articles and book excerpts) responds to the mushrooming growth in the field of environmental economics. Designed for students and researchers in developing countries, it presents several classic articles in the field, such as Hardin's "The Tragedy of the Commons" and Cropper and Oates on "Measuring the Benefits and Costs of Pollution Control." Other topics include externalities, resource depletion, sustainability, and the relationship between development and the environment.

U. Sankar, ed. (2001). Hbk., 469p. ISBN 019 5655605.

All from Oxford University Press/OUP India, YMCA Library Building, Jai Singh Road, PO Box 43, New Delhi 110 001, India. Tel: +91 11 373 2990, 374 7124/5, 373 4769, Fax: +91 11 373 2312.

country, with highlights of particular successes and analysis of remaining challenges. A regional vision of CP developments over the next few years is presented, with recommendations on how to move forward.

(2001). UNEP. Available from SMI (see above). Pbk., 60p. ISBN 92-807-1990-4.

Europe "Agreening": 2000 Report on the Status and Implementation of Multilateral Environmental Agreements in the European Region

This report is an updated version of UNEP's *Report on the Status of Multilateral Environmental Agreements in the European Region*, which was presented as a background document at the "Environment for Europe" conference on 23-25 June 1998 in Aarhus, Denmark. *Europe "Agreening"* covers 19 global, regional and sub-regional Multilateral Environmental Agreements (MEAs) selected by UNEP and the GEO 2000 collaborating centres. The region treated comprises Western Europe, Central Europe, Eastern Europe and Central Asia.

(2000). Regional Environmental Center for Central and Eastern Europe, Ady Endre ut 9-11, 2000 Szentendre, Hungary. Tel: +36 26 311 199, Fax: +36 26 311 294, E-mail: info@rec.org, Internet: www.rec.org. Pbk., 57p. ISBN 963-8454-85-7.

World Bank-Korea Environmental Management Research: Final Reports 2001

These three volumes, published by the Korean Ministry of Environment, result from studies commissioned from independent researchers by the Ministry and the World Bank. Each examines a different area of environmental management and includes case studies.

The Exploration of Corporate Environmental Risk Assessment for Sustainable Banking. Concludes with suggestions for action. *Pbk., 203p.*

Environmental Accounting Systems and Environmental Performance Indicators. Includes policy recommendations. *Pbk., 235p.*

Development of Environmental Management System for SMEs. *Pbk., 295p.*

(2001). Korean Ministry of Environment, Government Complex Kwacheon, Kwacheon 427-760, Republic of Korea. Tel: +822 504 9244, Fax: +822 504 9206, Internet: www.me.go.kr.

Environmental Performance Reviews: Ireland and Luxembourg

With these two countries, the OECD completed the first round of its Environmental Performance Reviews. The series now covers all OECD member countries as well as selected non-members. First-round EPRs include information on the reviewed country's geography, resources, social and economic situation, and environmental policy, legislation and institutions. Each review contains recommendations based on its analysis of the inte-

gration of environmental and economic policy conditions overall and in selected industry sectors, an assessment of current economic conditions and pollution management activities, and an evaluation of the country's record in meeting international environmental commitments. The second round of reviews, which include an examination of countries' responses to first-round EPR recommendations, recently began. They will be described in forthcoming issues of *Industry and Environment*.

Ireland. *Pbk., 180p. ISBN 92-64-18292-6.*

Luxembourg. *Pbk., 144p. ISBN 92-64-18293-4.*

(2000). OECD Publications (see above).

Latin America and the Caribbean: Environment Outlook 2000

This report is part of the initial response to a call by the Forum of Ministers of the Environment of Latin America and the Caribbean for support in defining regional environmental concerns and setting up harmonized information systems. It identifies urban air pollution and water shortages, destruction of forests (and hence biodiversity), and climate change vulnerability as the three key environmental issues in the region. Environmental stewardship has not improved in line with the increase in concern over such issues, the report notes. The state of the environment, policy responses and future perspectives are covered.

(2000). UNEP Regional Office for Latin America and the Caribbean, Boulevard de los Virreyes #155, Colonia Lomas Virreyes, 11000, Mexico DF, Mexico. Tel: +52 5 202 5851, Fax: +52 5 202 0950, Internet: www.rolac.unep.mx/evaluamb. Pbk., 144p. ISBN: 92-807-1952-1.

Environmental Protection: Review of European Union Legislation

The Europe Information Service (EIS), which reports on activities of the European Union and other European institutions, has published its latest single-volume compilation of EU environmental legislation, covering the period up to January 2001. Measures are categorized by topic (e.g. Water; Air – Climate Change; Land Use, Farming and Forestry). Each entry includes date of publication/adoption, reference to the relevant *Official Journal of the European Communities* and, where applicable, a description or comments.

A. Eckstein (2001). EIS S.A., 66 av Ad. Lacomblé, B-1030 Brussels, Belgium. Tel: +32 2 737 77 09, Fax: +32 2 732 6757, E-mail: eis@eis.be, Internet www.eis.be. Pbk., 133p.

Post-Conflict Environmental Assessment

UNEP Balkans has produced three reports on the most urgent environmental needs in the region in the wake of the Kosovo conflict:

Depleted Uranium in Kosovo: Post-Conflict Environmental Assessment *(2001) Pbk., 186p.*

This report presents the findings of a scientific field mission to determine the environmental consequences of NATO's use of depleted uranium weapons in Kosovo (see article above, p. 83). It includes a background chapter and a description of the mission, its findings, conclusions and recommendations, in addition to detailed, site-by-site findings and copious scientific appendixes.

Post-Conflict Environmental Assessment: Albania *(2000). Pbk., 80p.*

Post-Conflict Environmental Assessment: FYR of Macedonia *(2000). Pbk., 84p.*

Both these reports result from UNEP's rapid strategic environmental assessment, focusing on the most urgent environmental needs of the two countries. The assessment largely dealt with environmental "hot spots" requiring immediate attention, the environmental consequences of refugee influxes from the Kosovo conflict, and each country's environmental institutions and policies. The Albanian and Macedonian reports recommend immediate action for five "hot spots" in each country.

Available from SMI (see above).

EDITIONS FRANÇAISES

Le Guide du développement durable

Ce guide didactique est publié par Dexia Crédit Local de France, acteur majeur pour le financement des activités publiques locales, en partenariat avec le Ministère français de l'Aménagement du territoire et de l'Environnement. Il s'inscrit

dans le contexte du protocole d'accord que Dexia a signé avec le ministère, en 1999, pour encourager les investissements des collectivités locales contribuant à la protection de l'environnement et à l'aménagement durable des territoires. Le guide met en relief les enjeux du développement durable du territoire et le rôle des collectivités locales et des entreprises. Il examine la réglementation sur l'eau, les déchets et l'air ainsi que les principales aides et subventions accordées dans ces différents secteurs.

(2000). Dexia Crédit Local, 7-11 quai André Citroën, PB 1002, 75901 Paris Cédex 15. Tél: +33 1 43 92 76 63, Fax: +33 1 43 92 77 26, E-mail : eric.flamand@clf-dexia.com, Internet : www.dexia-clf.fr, Pbk., 34p. Supplément de Gestion locale, janvier 2000, ISSN 0754 5770.

Guide à la mise en place du management environnemental en entreprise selon ISO 14001

Préparer une démarche de certification ISO 14001 est un projet important qui demande des compétences qui ne sont pas forcément présentes dans chaque entreprise. Le but de cet ouvrage est de guider le lecteur dans cette démarche en fournissant à chaque étape les éléments essentiels et en analysant, pas à pas, les exigences de la norme et la méthodologie nécessaire à la réalisation du projet.

P. Baracchini (2001). Presses polytechniques et universitaires romandes, EPFL – Centre midi, CH-1015 Lausanne, Switzerland. Tél : +41 21 693 41 40, Fax : +41 21 693 4027, Pbk., 170p. ISBN 2-88074-411-3.

Vive l'eau

Ce petit ouvrage de vulgarisation traite des propriétés de l'eau comme ressource primordiale et conte l'histoire de la maîtrise de l'eau par l'homme à travers les âges. Remarquable pour ses illustrations, il a reçu l'un des deux prix décernés par la Fondation Altran pour l'innovation en 1999, distinguant une « innovation technologique améliorant de manière significative l'accès à une eau de qualité pour le plus grand nombre. » L'ouvrage présente en dernière partie des documents et témoignages dont celui de Klaus Toepfer, directeur exécutif du Programme des Nations Unies pour l'environnement (PNUE).

J. Matricon (2000). Gallimard, Pour comprendre : Fondation Altran pour l'innovation, 251 Boulevard Pereire, 75017 Paris, France. Tél : +33 1 44 09 54 47, Fax : +33 1 44 09 54 40, E-mail : communication@fondation-altran.org, Internet : www.fondation-altran.org, 143p. ISBN 2-07-053510-X.

Tourisme, environnement, territoires : les indicateurs

Ce document appartient à la collection « indicateurs » de l'Institut français de l'environnement (Ifen). Cette collection a, entre autres objectifs, de permettre le diagnostic des relations entre un secteur d'activité et l'environnement. Dans sa première partie, le document traite des indicateurs tourisme et environnement à l'échelle nationale. Il aborde ensuite les spécificités de quatre type de destinations : la mer, la montagne, la ville et la campagne.

(2000). Ifen, 61, boulevard Alexandre Martin, 45058 Orléans Cédex 1, France. Tél : +33 2 38 79 78 78, Fax : +33 2 38 79 78 70, E-mail : ifen@ifen.fr, Internet : www.ifen.fr, Pbk., 262p., ISBN 2-911089-38-3.

Web Site Highlights

UNEP Environment Network
www.unep.net

UNEP has launched this web site to bring together a large amount of well researched scientific information on the environment that has hitherto been fragmented across a wide variety of institutions and sites. The aim is to make it easier to sift through the information required to solve environmental problems, provide a forum for scientific technical peer review, and allow exchange of ideas and insights.

UNEP's purpose in forming the unep.net partnership was to begin a new global process of developing integrated solutions to well known environment problems while highlighting emerging issues. The site aggregates data for many countries and global regions: it allows users to select a country or environmental topic by pointing to a map, choosing from a list, or typing in a search term. Users can also generate custom maps and overlay them with facts and figures of their choice.

The unep.net partnership covers a broad range of environmental information and data providers, who are committed to making their information freely available. The site's decentralized and distributed system can query (and generate reports from) remote databases and servers. This means that when a partner upgrades a system or updates an information base locally, the benefits are realized directly by the whole partnership.

For more information, contact: Beth Ingraham, Information Officer, UNEP Division of Early Warning and Assessment, PO Box 30552, Nairobi, Kenya. Tel: +254 2 624299. Fax: +254 2 623293. E-mail: beth.ingraham@unep.org.

SDGateway
www.sdcn.org

The SDGateway integrates on-line information developed by members of the Sustainable Development Communications Network, a group of private organizations promoting more widespread and better integrated information and communications about sustainable development.

In addition to over 1200 documents, the site includes a calendar of events, a job bank, the Sustainability Web Ring, a roster of automatic mailing lists (listservs), and news sites dealing with sustainable development. SDGateway is maintained by the International Institute for Sustainable Development.

For more information, contact: SDCN, c/o IISD, 161 Portage Ave. E., 6th Floor, Winnipeg, MB, R3B 0Y4 Canada. Tel: +1 204 958 7700. Fax: +1 204 958 7710, E-mail: info@sdcn.org.

On-line Halon Trader
www.halontrader.org

The UNEP DTIE Energy and OzonAction Unit has opened a business-to-business (B2B) site, the On-line Halon Trader, to facilitate international exchange of "banked" halons, which are ozone-depleting substances. This is believed to be the first B2B site developed specifically to boost compliance with a multilateral environment agreement. Companies that need halon for critical applications can post listings of demand; companies or halon banks that are able to meet this demand with recovered, reclaimed or recycled halon can respond, or post their own listings about halons available for exchange.

For more information, contact: Rajendra Shende, Chief, Energy and OzonAction, at UNEP DTIE in Paris. Tel: +33 1 44 37 14 59. Fax: +33 1 44 37 14 74. E-mail: rajendra.shende@unep.fr.

FOOD for a Healthy Planet
www.uneptie.org/unido/food

UNEP and the United Nations Industrial Development Organisation (UNIDO) have launched a collaborative web site called "FOOD for a Healthy Planet" – with FOOD standing for Free Of Ozone Depletion – to communicate the results of demonstration projects on methyl bromide phase-out. It is the first site to provide information on the experiences and results of the nearly 60 projects in 36 countries financed by the Multilateral Fund of the Montreal Protocol.

For more information, contact: Senz Yalcindag, Director of Montreal Protocol Branch, UNIDO, Wagnamerstrasse 5, 1400 Vienna, PO Box 300. Tel: +431 26026 3347. Fax: +431 26026 6804. E-mail: syalcindag@unido.org; or Sidi Menad Si Ahmed, Head of Methyl Bromide Unit. Tel: +431 26026 3782. Fax: +431 26026 2134. E-mail: ssi-ahmed@unida.org.

Changes in UNEP URLs

UNEP's on-line Mineral Resources Forum-Environment and Offshore Oil and Gas Environment Forum have changed their Internet addresses (URLs). The new addresses are:

- Mineral Resources Forum-Environment: *http://mineralresourcesforum.unep.ch.*
- Offshore Oil and Gas Environment Forum: *http://oef.unep.ch.*

The OzonAction Programme has a new web site: *http://www.uneptie.org/ozonaction.html.*

Two new French-language sites
www.planetecologie.org

France's Association pour le Développement des Outils Multimédia appliqués à l'Environnement (ADOME) has opened Planet Ecologie, which it describes as the most comprehensive web site for environmental protection and sustainable development. It includes a meta-search engine, comparable to Copernic but specialized in environmental topics. There are over 5000 links to other environmental sites.

www.agora21.org/relief

To fill a perceived gap in information for francophone countries on sustainable development, three Quebec-based organizations have set up a site called RELIEF – for REseau de Liaison et d'Echange de l'Information Environnementale Francophone. The site is funded by the Fonds Francophone des Inforoutes and run by the Institut de l'énergie et de l'environnement de la Francophonie (a subsidiary of the Agence intergouvernementale de la Francophonie) with assistance and input from the Observatoire de l'écopolitique internationale de l'Institut des Sciences de l'Environnement de l'UQAM in Montreal, Agora 21/Ecole nationale supérieure des mines in Saint-Etienne, France, and the Réseau pour l'environnement et le développement durable en Afrique/REDDA in Côte d'Ivoire. The site can be reached via three different URLs:

- North America: www.iepf.org or www.er.uqam.ca/nobel/oci/relief;
- Europe: www.agora21.org/relief;
- Africa: www.nesda.org/relief.

For more information, contact: Michel Giran, ADOME (mgiran@yahoo.fr); or

Institut de l'énergie et de l'environnement de la Francophonie, Habib Benessahraoui, Directeur exécutif. Tél : +1 418 692 5727. E-mail: iepf@iepf.org.

THE UNEP DIVISION OF TECHNOLOGY, INDUSTRY AND ECONOMICS

Current uses and development of natural resources, technologies and production processes, as well as urbanization patterns, have negative effects on human health and the environment. This is illustrated by unsustainable use of water, land and energy, air and water pollution, persistent and toxic bio-accumulative chemicals in the food chain, and other industry-related problems.

To have a healthy environment, we need to change how we produce and consume goods and services. This change involves revising and developing economic policies and trade practices, so as to integrate environmental issues in the planning and assessment processes.

UNEP's Division of Technology, Industry and Economics (UNEP DTIE) was created in 1998 to help decision-makers in governments, local authorities and industry develop and adopt policies and practices that:

- are cleaner and safer;
- use natural resources efficiently;
- ensure adequate management of chemicals;
- incorporate environmental costs;
- reduce pollution and risks for humans and the environment.

UNEP DTIE, whose main office is in Paris, is composed of:

- **The International Environmental Technology Centre (Osaka)**, which promotes the adoption and use of environmentally sound technologies, with a focus on the environmental management of cities and freshwater basins, in developing countries and countries in transition.

- **The Production and Consumption Unit (Paris)**, which fosters the development of cleaner and safer production and consumption patterns that lead to increased efficiency in the use of natural resources and reductions in pollution.

- **The Chemicals Unit (Geneva)**, which promotes sustainable development by catalyzing global actions and building national capacities for the sound management of chemicals and the improvement of chemical safety world-wide, with a priority on Persistent Organic Pollutants (POPs) and Prior Informed Consent (PIC, jointly with FAO).

- **The Energy and OzonAction Unit (Paris)**, which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition, and promotes good management practices and use of energy, with a focus on atmospheric impacts. The UNEP/RISO Collaborating Centre on Energy and Environment supports the work of this Unit.

- **The Economics and Trade Unit (Geneva)**, which promotes the use and application of assessment and incentive tools for environmental policy, and helps improve the understanding of linkages between trade and environment and the role of financial institutions in promoting sustainable development.

UNEP

UNITED NATIONS ENVIRONMENT PROGRAMME

DIVISION OF TECHNOLOGY, INDUSTRY AND ECONOMICS

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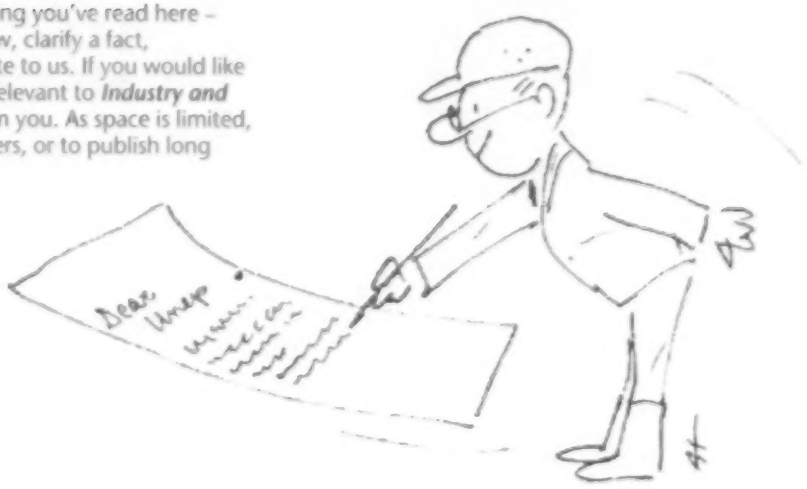

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a publication of the United Nations Environment Programme
Division of Technology, Industry and Economics

For over 20 years, the quarterly *Industry and Environment* has provided a forum for exchanging information and experience. Articles are contributed by industry managers, government officials, researchers and others active in the field of sustainable industrial development. Besides reporting on developments of broad international interest, each issue focuses on a particular theme. The themes of recent issues have included the agri-food industry, consumption patterns, urban environmental management, sustainable energy, and mining and sustainable development. For a list of past issues and their availability, contact UNEP DTIE or visit http://www.uneptie.org/hp_division_office.html.

The next issue of *Industry and Environment* will focus on ecotourism.

Industry and Environment is an English language publication, but it often includes articles in French and Spanish. All contributed articles are accompanied by summaries in English, French and Spanish.

The review is also published in Chinese.
For further details, please contact:
Professor Liu Xiaogwang
Research Center for Eco-Environmental Sciences
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